Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER THESIS

Financial Stress Transmission from Developed to Emerging Countries

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

Prague, January 7th, 2013

Signature

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Abstract

In this research we have analyzed the financial system as it is today, describing the implications financial innovation had and the impact of the recent financial crisis. We tried to understand the nature of the financial stress and its measures. In the context of world financial integration it was also necessary to have a review upon the financial stress transmission channels from developed to emerging countries, determining the linkages and their measures. We employed a structural VAR model to determine whether there is empirical proof of financial Stress transmission from developed to emerging countries and see if financial integration represents the decisive factor in financial stress transmission. Our results suggest that there is a significant impact of financial stress in developed countries on the output of emerging ones. However we can observe an increasing influence of country-specific factors in explaining the variation in the rest of the variable of our model. The results also indicate the level of international financial integration being an important condition for the financial stress transmission.

JEL Classification	C01, C51, C53, E30, F02, G10,
Keywords	Financial Stress Index, Developed Economies, Emerging Economies, Financial Crisis, SVAR, Small Open Economy.

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Acronyms

BIS Bank of International Settlements

CDOs Collateralized Debt Obligations

CDS Credit Default Swaps

CIS Commonwealth of Independent States

CPI Consumer Price Index

FEVD Forecasted Error Variance Decomposition

FSI Financial Stress Index

GDP Gross Domestic Product

GFSR Global Financial Stability Report

IMF International Monetary Fund

NPL Nonperforming Loans

SVAR Structural Vector Autoregressive

TBTF Too Big-to-Fail

WEO World Economic Outlook

Master Thesis Proposal

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Defense Planned:	February 2013

Proposed Topic:

Financial Stress transmission from Developed to Emerging Countries

Topic Characteristics:

Starting from the notion of globalization that has already deemed we can speak now of world integration. We can observe a strong relationship between advance and emerging countries through trade and financial channels. Many of the emerging markets rely on external financing and they also represent a possibility of market expansion as it is viewed by the advanced economies.

Considering the financial aspect, the volumes of lending to emerging markets and the whole financial activity has been intensifying during last decade becoming more integrated. However the development of the financial markets had to stagnate in the reality of the current financial crisis. This of course could not pass without having an effect upon real sector itself in the emerging markets, which is also a subject of our research. Considering the potential implications of the financial crisis started in 2008, this paper aims to empirically assess the intensity of the financial stress and its spread to the emerging markets. As financial stress represents periods when the financial system fails to execute its function of intermediation, it is of great interest to analyze the long term implications of financial stress, how fast it spreads to the emerging markets.

Hypotheses:

In this research paper we are going to consider the following hypotheses:

1. Does Financial Stress transmit from Developed to Emerging Countries?
2. Does the Financial integration represent the decisive factor in Financial Stress transmission?

Methodology:

In order to fulfill the proposed goals, we will start with analyzing the evolution of the recent financial crisis. We would like to establish the initial condition and main causes that lead to the crisis itself. Assessing he proper impact we will be able to determine the seriousness of this event. Based on the historical data and available statistics preliminary we would be able to intuitively answer the first hypothesis of our research. Basically all mentioned above points will be achieved combining quantitative and qualitative analysis.

The second part will be more focused on establishing the main channels of financial stress transmission and apply a SVAR econometric model in order to empirically assess the intensity of the financial stress transmission to emerging countries.

Outline:

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Author **Supervisor**

1 Introduction

The process of globalization is thought to have started after Second World War, and there are many aspect of it. However we can distinguish several features that contributed to the world integration. These are: 1. internationalization of production including changes in structure of production, 2. expansion of international trade and services, and 3. widening and deepening of international capital flows. (Mrak, 2000) As the proper financial integration took place through institutions and capital flows, recent financial crisis has proven that world integration can bring both benefits as well as risks.

In recent years a number of studies analyze the impact of recent financial crises on world economy, focusing on financial linkages between advanced and emerging countries, on cross-border determinants of capital outflows and spillover effects. However we paid more attention to the ones exploring the impact of financial stress episodes on real economy. (Cardarelli, Elekdag, & Lall, May 2009) for an example, have determined that financial stress is not always a precursor to an economic slowdown or recession. Moreover their results indicate that particularly banking stress tends to have a greater effect on economy, and recessions caused take about five quarters to recover. (Balakrishnan, Danninger, Elekdag, & Tytell, June 2009) determined signs of financial stress transmission from advanced economies to emerging ones, rising the levels of financial stress in emerging countries above those seen during the Asian crisis. The authors also established that financial links have a significant effect in the transmission process, making reference to bank lending to emerging countries. (Kim, Kim, & Ro, 2011) Apply a SVAR model in order to investigate the dynamic relationship between financial uncertainty and real output growth in Korea. The authors found that U.S. financial stress significantly decreases growth in real output for at least two quarter. Another research paper analyzes the spillovers of three distinct external shocks in the ASEAN -5 economies. (Hwa, April 2012) has found that external financial shock transmit to the specific countries causing output and prices to decline. We should mention that the obtained results

differ among countries depending on which extent the economies are exposed to external financing.

Our study concentrates on establishing if there is any empirical proof of financial stress transmission from Developed to Emerging countries. Applying a structural vector autoregressive model we are going to analyze how a global financial shock in advanced countries impacts the real economy of a sample set of countries chosen arbitrarily from the list of emerging countries. As a benchmark for the level of financial stress in developed countries we are going to use the Financial Stress Index (FSI) developed by (Cardarelli, Elekdag, & Lall, May 2009). We also are making an assumption that each emerging country behaves as a small open economy, thus it is heavily dependent on external environment and has no influence upon developed economies. As a result of our analysis we would like also to determine if financial integration represents the decisive factor in Financial Stress transmission.

The thesis is structured as follows: Chapter 2 reflects a historical perspective on current financial crisis describing the new elements brought to the financial system. As well it presents the impact of the crises on world economy. Chapter 3 provides a proper definition for the financial stress and its measures. We are also describing the financial transmission channels from developed to emerging countries. Chapter 4 presents the empirical methodology applied and interprets the dataset and empirical results. Chapter 5 summarizes our findings.

2 Financial System in the Reality of Current Financial Crisis

2.1 A historical perspective on the current financial crisis

The recent financial crisis may be viewed just as a common pattern of the world economy as we have developed it. Nowadays events reflect just consequences of an imperfect system that has been continuously modified and adjusted to each event threatening to crush an economy that seemed at some point to have signs of stable growth. Examples include the crises of 1857, 1893, 1907, 1929-1933, 1973, 1987, 1998, 2000. Both advanced and emerging economies have known devastating financial collapses, but none of these events had reached such a wide spread since the Great Depression.

According to business cycle theory economies register a repeating pattern. Cycles consist of five stages: expansion, peak, recession, trough and recovery. Therefore we can assume that each cycle shares specific common characteristics. Mainly we can speak about common conditions to past financial crises. (Reinhart & Rogoff, 2008) As crises always have been a subject of research, economic literature is rich in studies and databases keeping track of past events. We will make reference to the work of (Laeven & Valencia, 2008), who created a database of systemic banking crises for the period 1970-2007 providing details on crisis containment and resolution policies. The authors have identified several conditions prior to the crises which are characterized by asset price increases, lending booms which led to excessive indebtedness, weak macroeconomic condition build-up of marginal loans and systemic risk. Large macroeconomic imbalances and unsustainable fiscal policies are considered to be the origins as an example of the crises in Russia (1998), Argentina (2001), on average the fiscal balances tending to be negative (-2.1 on average), current accounts being in deficit by 3.9 percent and inflation reaching on average as high as 137 percent. However, the nature of the East Asian crises was more characterized by foreign exchange risk and unsustainable maturity composition of debt. Respectively the non-performing loans tend to reach levels of 75 percent of

total loans and a share of 25 percent of loans. A substantial risk could also represent the connected loans that may impact several banks at once in case of a crisis. Another common condition represents a rapid credit growth. Average annual growth in private credit to GDP prior to the crisis is about 8.3 percent and reaches 34.1 percent the maximum. These booms often took place as a result of a process of financial liberalization. Nonetheless crisis-affected countries often suffer from weak legal institutions, benefiting a low assets quality.

In 2008, the collapse of Lehman Brothers Bank became the symbolic start of the most dramatic financial crises since then, gaining its name of Great Recession, as we all know the recent financial crisis. The connection does not end here. Making reference to (Partnoy, 2009), it was during the 1930s when regulators developed rules based on credit ratings. These may be considered the initiation of today's regulatory reliance on ratings, and we can only guess what would have happened without financial innovation and overreliance on credit ratings.

Analyzing the initial conditions we could classify the respective factors in two major groups: Macroeconomic and Microeconomic. Macroeconomic environment can be characterized by almost a decade of low global interest rates inducing excess of global liquidity, figure 2.1. This in turn contributed to increase in demand for credits and investments leading to a significant increase in housing prices, figure 2.2.

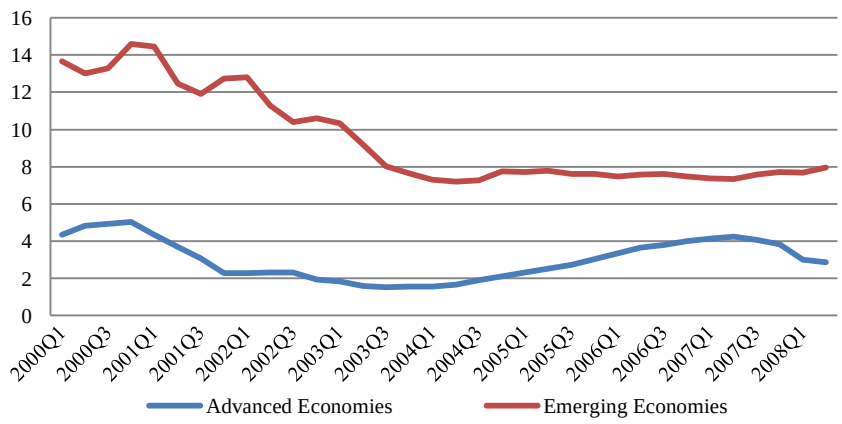

Figure 2.1: Real interest rates 2000 – 2008 (Percent change from one year earlier)

Source: IMF, WEO, October 2008.

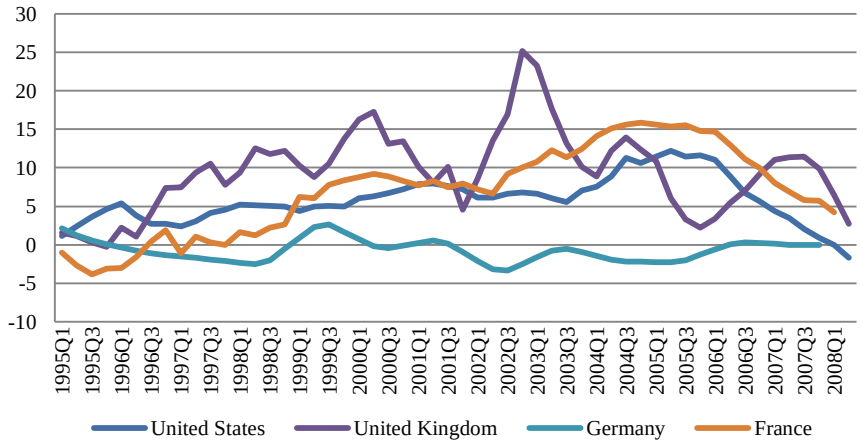

Figure 2.2 Residential Property Prices (12-month percent change)

Source: IMF, WEO, October 2008.

At the microeconomic level, low short term interest rates initiated a pursue on the part of banks and institutional investors for yield. A series of financial innovations (Bhatia, 2007) were meant to provide these higher returns but in exchange many of them were to sacrifice transparency, therefore increasing risk. This peculiarity generated new instruments of securitization, which allowed large commercial banks to generate loans in order to sell them on to other financial institutions, who in turn would bundle them into asset-backed securities and so forth. The reason for these loan sales was the transfer of risk to the ultimate buyer of the security, which by idea should have been backed by the underlying mortgage loan. A misperception of the risk involved, made the market believe that there was an arbitrage opportunity and only increased the demand for these products. Due to this scheme banks profited from administrative and process fees without having to fulfill capital requirements or need to raise liabilities to cover the assets. Low interest rates also diminished the incentives to keep on-balance-sheet liquid assets. (Barrell & Davis, 2008)

The imperfection of the regulatory system overlooked the vulnerabilities induced by this process. Respectively the heavily regulated sector became the originators of this process, transferring the risk to the ultimate holders of the securities, who were beyond the scope of regulators. As a result the regulated segment ended up being significantly affected due to spillover effects and high levels of systemic risk. (Laeven & Valencia, 2008)

In fact we can observe that a single piece of financial innovation lead to the creation of a risky environment. Traditionally we could claim that banks shed just a few risks from their balance sheets, such as consumer credits or generally risks that were less sensitive through loan sales or credit guarantees. However credit derivatives, as example Credit Default Swaps (CDS), allowed banks to trade credit risks on a variety of exposures. The market grew rapidly, the value of CDS in G10 countries according to Bank of International Settlements (BIS) statistics was under 60 trillion US dollars. (IOSCO, 2012)

Making reference to the work of Nathaniel Frank and Heiko Hesse, we can say that the origins for recent crisis were mainly the quality of subprime mortgages rather than a liquidity problem. Rising interest rates for refinancing and falling house prices increased the delinquencies on subprime mortgages. As a result, the uncertainty concerning the value of structured credit products only increased. A logical response reaction followed, downgrading many of the related securities and changes of the evaluation methodology by rating agencies. It was only a matter of time until investors would avoid investing in structured products. (Frank & Hesse, 2009)

We could better assess the magnitude of the current financial crisis comparing the losses to past events. As we can see in Figure 2.3, by 2008 only bank losses amounted 775 billion U.S. dollars, exceeding even the Japan banking crisis which lasted a decade.

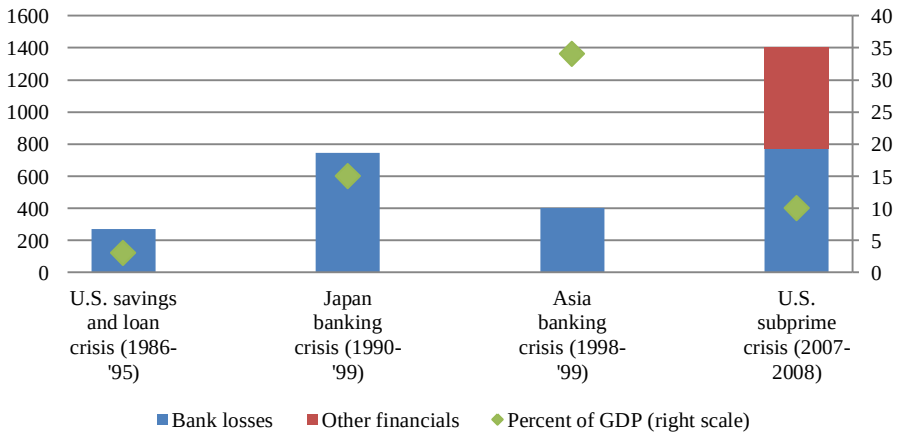

Figure 2.3 Comparison of Financial Crises (losses in billion dollars)

Source: IMF, Financial Stress and Deleveraging, Macrofinancial Implications and Policy, 2008.

As we have mentioned it earlier the financial innovation brought some new features to the recent financial crises, these including more sophisticated financial intermediaries and instruments, as well as an increased level of interconnectedness. As a consequence a large reliance on wholesale and short-term funding turned to be a systemic fragility. Too Interconnected-to-fail or Too Big-to-Fail (TBTF) represent two notions highly discussed in the context of recent financial crises. The first one is usually pointed out to be the more accurate to speak of. Both the economists and politicians could spot the moral hazard threat. The TBTF financial firms are tied to many other firms in other financial markets, therefore if they fail it can easily set off a chain of reaction that leads to widespread collapse of many financial firms and markets. The common sense suggests that government and central bank will not allow the economy to face such a threat. Knowing this, many of the firms would take too much risk and leverage beyond the moral hazard on which the economic argument focuses. The political argument is always closely related with the economic one, large institutions with much disposable cash usually benefit of a privilege in the political organizations, making the bailouts more likely. (McDonnell, 2008)

However, according to (Eichengreen, 2009), the existence of such firms does not represent the main problem. Deregulation, as represented by the Gramm-Leach-Bliley Act in the U.S. and the Single Market Act in Europe, allowed financial institutions to take on additional risk. The regulated sector had to compete with a large number of unregulated institutions and markets which in their activity are very similar to banks and are also subject of contagious panics. Size and diversity of the institutions contributes to economic stability, but deregulation manages to create a system which includes “shadow” banking. These are only consequences of a vital necessity to cope with increasing competition.

The financial conditions in the household sector are vital in every crisis but in the recent one played an unusually notable role. The majority of the earlier episodes of financial distress originated in the official sector (e.g., Latin America’s debt crisis of the 1980s) or the banking and corporate sectors (e.g., the East Asian crisis). The recent crisis was different, the financial distress being spread through mortgage loans, creating a direct link between the financial and real sector. (Claessens, Dell'Ariccia, Igan, & Laeven, 2010)

2.2 The performance of countries during financial crisis

Before starting our analysis of the impact the recent financial crisis had upon world economy we would like to mention some interesting findings provided by IMF. We would expect that episodes of financial stress would lead to a significant or noticeable effect on real economy, but only half of the 113 episodes identified during 30 years, lead to an actual slowdown or recession. However, the nature of a stress episode represents a key determinant of the impact magnitude. As the recent crisis has a financial nature we find relevant to mention, that the same study indicates episodes associated with banking crises to have a more severe macroeconomic impact than others. The impact manifests through twice as long periods characterized by negative dynamics and twice as intense, resulting in four times bigger cumulative output loss. (International Monetary Fund, April 2009)

Speaking about the proper impact of the crisis it was estimated that the global GDP contracted by 6.96 percent (annualized) only in the fourth quarter of 2008, and has fallen by 5.84 percent in the first quarter of 2009. Figure 2.4 reflects global GDP growth rates as of first quarter in 2007 to the forecasted growth rates in third quarter 2013. The advanced economies registered 8.71 percent and 8.35 percent decline in the same period respectively. According to WEO from April 2009 world industrial production plummeted in the fourth quarter of 2008 and fall by 12.07 percent in 2009.

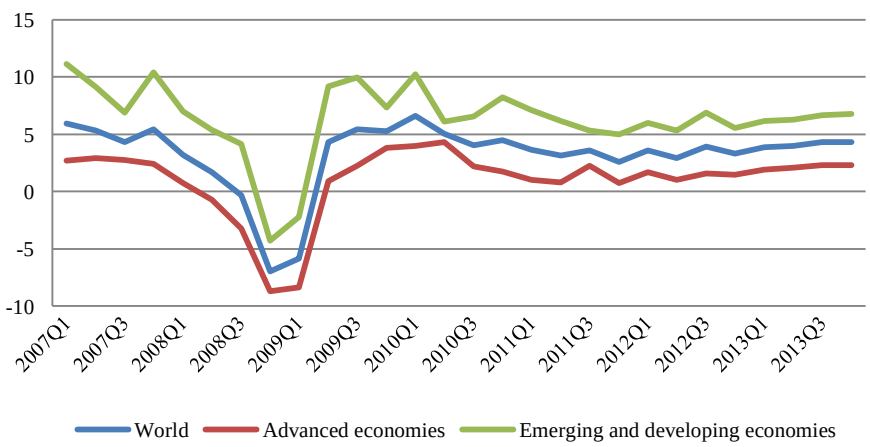

Figure 2.4 Global GDP Growth (percent; quarter over quarter, annualized)

Source: IMF, World Economic Outlook, Update July 2012

We can also outline that emerging countries have also suffered hardly; from a 4.16 percent increase in GDP registered in the third quarter of 2008, it fall by 4.30 percent (annualized) in fourth quarter, followed by an average 2.23 percent decline in first quarter of 2009.

The global economy was expected to contract by 1.3 percent in 2009, nevertheless according to (International Monetary Fund, April 2010) it registered a 0.6 percent contraction; however the numbers differ much among countries.

Speaking about the Emerging and Developing Economies, the worst affected region represents the Commonwealth of Independent States (CIS) seeing a contraction of 6.6 percent. It was followed by Central and Eastern Europe countries facing a contraction of 3.7 percent. Some other regions managed to avoid recession, knowing declines in marginal growth rates, such as Developing Asia, Middle East and North Africa. Having a comparative analysis for example ASEAN countries grew only by 1.7 percent in 2009, comparing to 6.3 percent growth in 2007. We would like also to remark that while the emerging Asia has been growing by ~ 2 percent, developing countries in the region managed to grow by 6.6 percent. China and India grew only by 8.7 percent and 5.7 percent respectively comparing to 13 percent and 9.3 percent in 2007 respectively. Guiding same IMF publications we can say that downturn in many Asian economies in late 2008 was of a greater magnitude and speed than expected, but the same was the recovery.

On the other side Advance Economies had a more pessimistic performance, registering a contraction of 3.2 percent in 2009, and specifically United States (-2.4), Euro Area (-4.1), Japan (-5.2), Germany (-5), France (-2.2), United Kingdom (-4.9), Italy (-5), Spain (-3.6).

As concerning the financial impact, we can start from analyzing the dynamics of nonperforming loans (NPL). The April 2010 Global Financial Stability Report (GFSR), indicates that the NPL in United States for example increased from 0.8 percent in 2006 to 5.4 percent in 2009, United Kingdom from 0.9 percent to 3.3 percent. On average the percentage of NPL in Advanced Economies doubled. In the case of Emerging Economies the figures are also pretty spread. An example for the heterogeneity is Romania and Turkey where NPL grew from 2.8 percent in 2006 to

14.8 percent in 2009, as in the second country we see an increase from 3.9 percent to 5.7 percent. A better image can be obtained by looking to the volumes of bank write-downs and loan loss provisions over 2007–10 were initially estimated to reach 2.8 trillion U.S. dollars, but the estimations were lowered to 2.3 trillion U.S. dollars, two-thirds of which had been recognized at the end of 2009. Thus in order to quantify the losses we can say that the share of total write-downs out of total loans of U.S banks represented 7.3 percent equal to 588 billion U.S. dollars, and the share out of total securities is 6.6 percent which represent 296 billion of U.S. dollars. In the case of Euro area banks total loans and securities write-downs constituted 665 billion U.S. dollars. United Kingdom was also majorly affected, the volume of write-downs reached 455 billion U.S. dollars. (International Monetary Fund, April 2010)

Investment was meant to sustain the growth of the economies, but in the conditions of high uncertainty it had to be postponed, economies having to rely mostly on consumption. Thus in advanced economies real gross fixed investment growth rates started to diminish even starting second quarter of 2007, reaching its worse situation in first quarter of 2009, that is a contraction of 21.51 percent. Specifically the investment in machinery and equipment has known a contraction of 27.9 percent. As presented in figure 2.5 the crises left long term impact on investment, advanced economies having to cope with negative growth rates even in 2011.

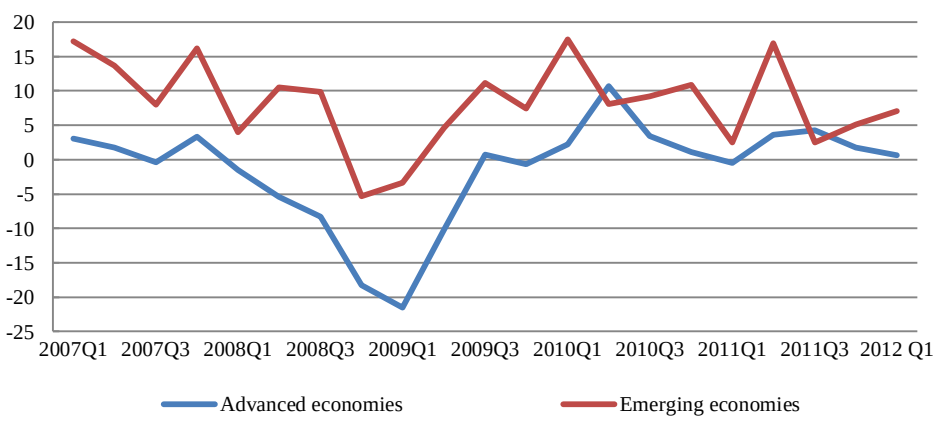

Figure 2.5 Real Gross Fixed Investment (percent; quarter over quarter, annualized)

Source: IMF, World Economic Outlook, Update July 2012

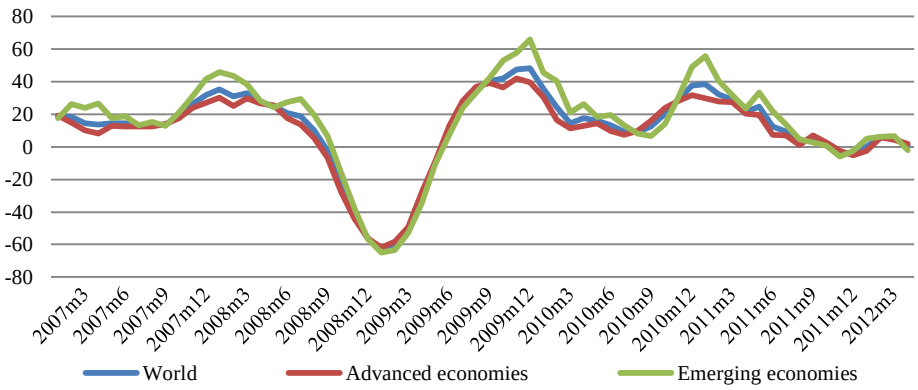

Figure 2.6 Merchandise Exports

(percent; three-month moving average (3mma) over previous 3mma, annualized)

Source: IMF, World Economic Outlook, Update July 2012

Emerging economies faced its worse period during fourth quarter of 2008 and first quarter of 2009, registering a contraction of 5.32 percent and 3.4 percent respectively.

We should also mention that in 2009 the world trade volume contracted by 10.7 percent. Both imports and exports registered negative growth rates. More specifically imports registered in Advanced Economies (-12 percent), in Emerging and Developing Economies (-8.4 percent). Exports had similar performance registering in Advanced Economies (-11.7 percent) and in Emerging and Developing Economies (-8.2 percent). Figure 2.6 reflects merchandise exports' growth rate in Advanced and Emerging economies. Therefore we can see that in January 2009 world's three month moving average of exports reduced by 62.79 percent comparing to volumes registered in the month before that. In fact throughout 9 months, starting September 2008, the world exports registered a negative trend, this pattern being common for both Advanced and Emerging economies.

3 Financial Stress Transmission Analysis

3.1 Defining Financial Stress and its measures

The recent financial crisis represents a great example for the periods of financial instability and stress resulting in massive impact on world economy. Despite the fact that it has originated in the financial sector it affected the real economy through various channels. Similar to recent financial crisis, threats originated at the micro level, such as the shocks that affect the creditworthiness of borrowers, transmit to macro level, increasing the output fluctuations through the financial accelerator. That is, as the consent of the financial system to grant credit to the economy directly depend on the values of collateral. From the lender's point of view, events and factors impacting the balance sheet will also increase economic downturns. As a normal response reaction banks usually become more selective in providing capital to the real sector or suspend providing credits, leading to sharper economic downturns. Thus we can confirm that the development and structure of the financial system determine the degree of interconnection between real and financial sectors in the economy. (Peltonen & Lo Duca, March 2011)

Nowadays we can observe and realize the importance of the financial sector in the economy, thus it is vital to understand the impact of the financial cycles on real economy and how they emerge, episodes of financial stress being analyzed and taken into account. Although it is hard to define or specify a certain definition for the financial stress, according to (Hakkio & Keeton, 2009) "*financial stress can be thought of as an interruption to the normal functioning of financial markets"*. According to (Grimaldi, June 2010), "*financial stress is the product of vulnerable markets and of shocks that can be exogenous or, more likely, endogenous"*.

According to the same authors these episodes tend to involve certain phenomena which are associated to the financial stress. Generally speaking financial stress can be identified by the presence of relatively high uncertainty among lenders and investors about the fundamental value of financial assets. The resulting cash flow from stocks, bonds and loans depend on forthcoming economic conditions, thus high

uncertainty about these conditions make investors and lenders become less sure of the present discounted value of the cash flows, and as a consequence of the fundamental value of the financial asset. Making reference to the recent financial crisis, we can outline the notion of Knightian uncertainty, which arise in the cases when new financial instruments or practice register losses for the first time, being the case of collateralized debt obligations (CDOs). Thus lacking any historical experience, investors may lack any reasoning about the probabilities of returns to the product, as a consequence increasing uncertainty about the fundamental value of the asset.

The investor's risk profile is one pattern that everybody is used to consider, but another form of uncertainty increasing during financial crises concerns the behavior of the investor. As the expected return for an investor depends both on the hold-to-maturity value of the asset and actions of other investors, they come up with anticipating "what average opinion expects average opinion to be". This particular behavior becomes more emphasized when investors become more uncertain about the fundamental values of assets. Consequently when investors form their opinions based on assumptions about other investors' decisions, prices of financial assets do not reflect any more the fundamental values which leads to increased volatility of asset prices.

Another sign of financial stress represents the increased asymmetry of information between parties in a financial transaction. It is important to mention that information gaps or information asymmetry can lead to problems of adverse selection or moral hazard. As a result we can observe increases in average cost of borrowing and reduction in average price of assets on the secondary market. Making reference to the recent financial crisis, we can recall that owners had an informational advantage in estimating how much the securities were worth, as a consequence of complexity of structured financial products. Hence we can claim that asymmetric information concerning the true value of the asset generates the "lemons problem", which states the case when a buyer does not know whether the agent is selling the security because of a need for liquidity, or because he is trying to get rid of the toxic assets. As follows it would be easier to assume that most securities offered for sale are of low quality. (Kirabaeva, September 2009)

The fourth sign of financial stress can be characterized by a strong

unwillingness to hold risky financial assets, which offers a good reasoning for lenders and investors to demand higher expected returns on risky assets and lower returns on safe assets. Thus widening of spreads between the rates of return on the two categories of assets can be observed and an increase in the cost of borrowing for relatively risky borrowers.

As the market conditions worsen during crisis, investors' preference for liquidity is increasing, this being the last sign of financial stress. This aspect is also manifesting through widening of the spread between the rates of return on the two types of assets and leads to increasing the cost of borrowing for those firms issuing relative illiquid securities. Facing a thin secondary market for the issued security, the investor also risks to be forced to offer big cuts in price, when trying to resell it. Therefore wide spreads are meant to compensate for possible losses.

3.1.1 Financial Stress Index

Financial distress such as asset price bubbles bursts, financial and currency or banking crises impact the economy represent the ground for the stress observed in several market segments. The larger and broader the shock is, the higher the co-movement among variables reflecting tensions. Level of stress can be considered as being induced by the interaction between financial exposure and the size of the shocks. A measure of financial stress able to identify these systemic events can be considered a *Financial Stress Index (FSI)* evaluating at which levels it has, on average affected the real economy. In economic literature, we can encounter various indexes constructed by aggregating variables, which size the stress across markets segments, and aim to capture the start and the evolution of a crisis.

One of the examples to consider is the Kansas City Financial Stress Index (KCFSI), constructed by (Hakkio & Keeton, 2009). The variables included reflect prices or yields on financial markets, as market prices and yields incorporate the largest amount of information and quickly respond reflecting the changes in financial conditions. Considering the frequency requirements and availability of data, the Index comprises the following data: 3-month LIBOR/T-Bill spread, 2-year swap spread, off-the-run/on-the-run 10-year treasury spread, Aaa/10-year Treasury spread,

Baa/Aaa spread, high-yield bond/Baa spread, consumer ABS/5-year Treasury spread, correlation between returns on stock and treasury bonds, implied volatility of overall stock prices, idiosyncratic volatility of bank stock prices and cross-section dispersion of bank stock returns.

Another comparable index was developed by the economists from the Bank of Canada (Illing & Liu, June 2003). The authors tested different weighting methods for aggregating the index, applying: Factor analysis method, Credit weights method, Variance-equal weights method and Transformations using sample cumulative distribution functions (CDFs) method. We can mention that the index developed by Illing and Liu has some common variables with the KCFSI, such as a corporate bond spread, a measure of liquidity in the Treasury market (the bid-ask spread), and a measure of volatility in the overall stock market. It is also important to mention that the Bank of Canada considered it relevant to include index variables such as exchange rate volatility, that are to be considered in the case of a small open economy like. Other differences we can outline are that Canadian authors included the slope of the yield curve, which is related more to monetary policy than financial stress. However it fails to include any measures of investor uncertainty about bank stock prices.

In a recent European Central Bank research regarding financial stress in the euro area, the author (Grimaldi, June 2010), selected 16 market-based individual variables as basic financial measures. Being more specific, the variables reflect vulnerabilities in the corporate and government bond, banking, equity and money markets. The constructed index also contains several measures such as implied stock volatility, in order to reflect the mood of financial markets and measure of agents' risk attitudes

A financial stress index to which many papers make reference, and aligns with the objectives of our research is the one constructed by (Cardarelli, Elekdag, & Lall, May 2009). We can outline several disadvantages of previous mentioned indexes: historical approach applied by other authors capture only episodes that had large output consequences and, and less consideration has been given to episodes of financial stress with little macroeconomic impact. We can also mention the fact that these indexes fail to identify when financial stress peaked, and whether an economic

downturn can meaningfully be linked to the financial stress episode. Also they fail to identify episodes of considerable duration and varying intensity. The last argument refers to the banking and currency crises, where the historical approach pay little attention to pure securities market stresses or liquidity squeezes. Therefore in order to overcome these drawbacks, Cardarelli identifies episodes of financial stress as extreme values of a composite variable.

The Financial Stress Index computed for each country is constructed as a variance-weighted average of three sub-indices being representative for the banking, securities and foreign exchange market. As follows we will shortly describe each variable included.

Thus the first component of the bank related sub-index is the Banking sector β which is a measure of the correlation between the total returns to the banking-sector stock index and the overall stock market index. According to the Capital Asset Pricing Model, a beta greater than one, suggests that the banking sector is relatively risky. Considering that banks generate income by transforming short-term liabilities (deposits) into longer-term assets (loans), the authors use the inverted term spread which is computed as the difference between the short-term and long-term yields on government issued securities. A negative term spread may be an indicator of a serious decrease in banking profitability. And the last one is the TED spread, which is computed as the difference between interbank rates and the yield on Treasury bills, representing a proxy for counter party risk.

In order to capture the stress events in the securities market, corporate spreads were selected as a proxy for risk in the debt market, being computed as the difference between corporate bond yields minus long-term government bond yields. Stock market returns is used to capture the observation that many asset prices tend to reflect volatility clustering, especially when uncertainty rises in financial markets.

As for the foreign exchange-related sub-index, time-varying volatility of monthly changes in the nominal effective exchange rate was used being derived from a GARCH (1,1) specification.

The index constructed by Cardarelli, simplifies the identification of four fundamental characteristics of financial stress events: large shifts in asset prices

which are identified with the help of stock and bond market returns; an abrupt increase in risk/uncertainty (stock and foreign exchange volatility); abrupt shifts in liquidity (TED spreads); and the health of the banking system (the beta of banking sector stocks and the yield curve, which affects the profitability of intermediating short-term liabilities into long-term assets). Analyzing this subcomponents it can be possible to identify which types of financial stress (banking related, securities market related, currency related, or a combination of these) have been associated with larger output consequences.

The authors of this paper have chosen to apply an asset-price strategy in order to determine the financial stress events, as it will offer several advantages comparing to the quantity-based approach recommended by the corporate finance literature. FSI was constructed for each of the 17 countries in the sample selected by Cardarelli. If we recall the events in the recent financial crises, we would appreciate the increasing importance of the financial sector in the economy, and moreover the second reason for supporting the asset price based approach is the fact that, changes in broader financial asset prices can be expected to have a greater role in the ability of financial firms to supply intermediation services than in the ability of specific nonfinancial corporates to fund new investment. As a third reason to support their decision, the authors imply that it offers are better perspective in determining which financial stress episodes are associated with a significant economic impact, identifying initially the financial stress events based on asset prices, and then using quantity-based variables.

As follows, figure 3.1reflects the evolution of the financial stress in Advanced and Emerging economies. The index reaches its maximum level for both advanced and emerging economies in the fourth quarter of 2008. The figure shows that the financial stress index was higher in advanced economies like never before, and in emerging countries the levels exceeded those registered during Asian crisis. We can also observe that financial stress in emerging countries' financial stress crossed the zero levels with a delay of 3 quarters comparing to the dynamics in advanced economies, representing the time delay necessary for the stress transmission.

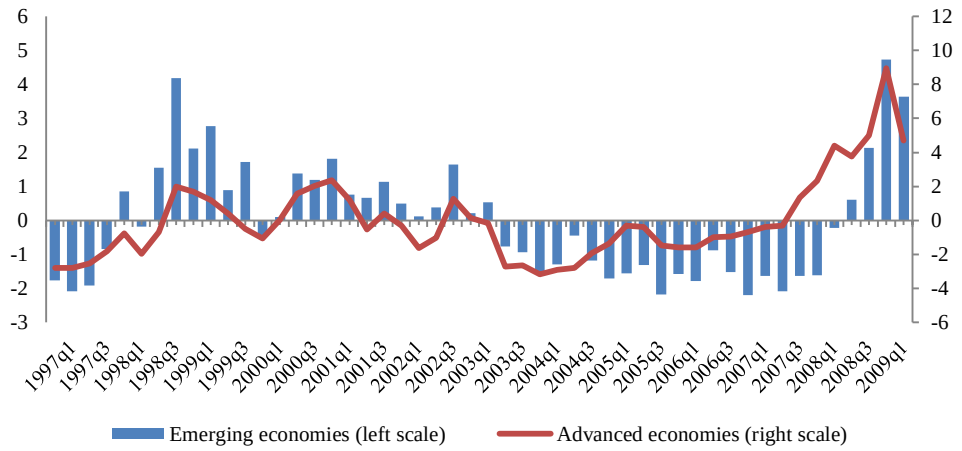

Figure 3.1 Financial Stress in Emerging and Advanced Economies

(Level of index, GDP weighted)

Source: IMF, WP/09/133.

3.2 Transmission Channels from Developed to Emerging Countries

Although recent financial crisis originated in developed countries, we cannot make abstraction of the consequences it had on emerging markets and attribute the negative dynamics to other episodes. As we have mentioned previously, the financial integration of world economy took place through institutions and capital flows. Therefore we can speak of specific transmission channels that allowed for contagion among countries.

In their research (Lane & Milesi-Ferretti, 2010), described a few channels, and mainly the one mostly related to the recent financial crisis represents: the exposure to U.S asset backed by sub-prime mortgages. The study also indicates that a rather high exposure was in several developed European countries such as: Germany, United Kingdom, and France. A relevant measure to capture the size of the transmission channels is thought to be the cross-border position. Further the authors would present the banks pulling back funds as being another transmission channel to be considered. As many emerging economies would rely on external financing and mainly bond financing we can consider it a relevant channel. We should also mention that during the crisis hedge fund and other financial intermediaries were forced to

reduce leverage because of the withdrawals. This intensity of this channel can be sized taking into account measures of gross and net external debt liabilities.

Global increase in risk aversion is also mentioned to be a driver of financial stress among countries. This channel in turn is influenced by the size of the real estate and asset price bubbles as well as by the volumes of additional losses originated from the underpricing of risk.

And the last channel identified by the authors represents the global collapse in trade, and particularly in demand for durable and investment goods, driven by uncertainty, scarce availability of credits. Here we would like to stress one important factor as degree of trade openness which increases the risk to external demand shocks.

The size of this linkage can be measured by dividing exports to advanced economies to domestic GDP. The statistics for the past 20 years indicate that trade linkages have become increasingly important. As a share of GDP in emerging economies, the exports to advanced economies has risen from less than 10 percent to nearly 20 percent. One interesting aspect of crisis transmission via both trade and financial linkages represents the possibility of second-round effects, which takes place through spillovers from affected emerging economies back to advanced economies and also through spillovers within the group of emerging economies. (International Monetary Fund, April 2009)

Stéphane Dees & Filippo di Mauro supports trade channel as being important in the transmission process. The increasing relevance of external trade makes economies more vulnerable to external shocks, either positive or negative. It is important to mention that theoretically, the impact of trade integration on synchronization of cycles depends on the nature of trade whether it is intra- or inter-industry trade and the type of shocks, the empirical evidence shows a strong, positive link between trade linkages and output correlation. As concerning the financial channel the authors make reference to the studies of Imbs, (2004 and 2006), sustaining that while some studies have pointed out a positive relationship between financial integration and business cycle co-movements in the case of advanced economies, this result runs against the forecasts of a standard international business

cycle model and is challenged when it is extended to developing economies (Backus et al., 1992). (Dees & di Mauro, 2010)

Moreover in their study Dees & di Mauro state the fact that countries with similar patterns of sectorial specialization are more likely to be hit by similar industry-specific shocks. This should make their business cycles more synchronized, all other things being the same. That is why it is relevant to consider cross-country differences in sectorial specialization.

In their study (Kamin & DeMarco, 2010) tried a different approach identifying two rationales for the contagion and financial stress transmission. Direct contagion, refers to changes in asset prices and other financial developments that link to financial linkages. For example oil prices represent a sensitive factor that can impact the economy and spreads across countries. But these also spread through trade, bankruptcy, or high uncertainty. As in the case of recent financial crisis the holding of U.S assets or dependence on U.S. dollar funding can be included among main linkages. Indirect contagion refers to herding behavior and panics across countries.

We find interesting the classification proposed by the International Monetary Fund, distinguishing between common and country-specific factors. Global shifts in market sentiment, cross-country contagion and herding behavior in markets represent co-movement of stress that has similar effects across countries. This effect and mainly the significance of these factors are closely related to the level of financial integration of the emerging countries in the world financial system. These particular factors can be attributed to common ones. On the other side, country-specific factors refer to economic and financial linkages between developed and emerging countries, as well as domestic environment which is highly influenced by the structure, specialization, policies and domestic vulnerabilities. (International Monetary Fund, April 2009)

In the same WEO, the authors give a more quantitative measure for the transmission channel that goes along with the theoretical background in the studies analyzed earlier. Starting from the idea that stress can commence as a response to actual or incipient capital outflows originated by investors in advanced economies

following a financial shock. Then we can estimate the size of the channel by dividing foreign liabilities to advanced economies to domestic GDP. We should also consider the opposite channel that links to the emerging economy assets invested in developed economies experiencing a crisis. A respective measure for this channel would be the ratio of assets held in advanced economies to domestic GDP. Analyzing the data we can say, that the later one is relevant for the Middle East countries, which are known for massive capital exports.

A more microeconomic perspective is considered in the study of Goldstein (1998), who introduces the notion of "wake-up call". It refers to the behavior of investors, when a crisis in one country might influence them to have similar expectations of losses for the other countries with similar characteristics, as a result inducing stress episodes without an existent threat. Alternatively making reference to Hendricks, Kambhu, and Mosser, (2006) a run on the liabilities of financial institutions in one country might raise concerns about the liquidity positions of institutions in other countries, creating premises for institution runs.

4 Empirical Analysis

4.1 Methodology

In order to investigate the relationship between the financial instability and real economy, we are going to apply a structural VAR (Vector Autoregressive) model which is a standard multivariate time series model.

In 1980, Christopher A. Sims suggested using the model for forecasting macro time-series. As VAR assumes that all the variables are endogenous, it models the variables as an autoregressive function of their lagged values. This pattern is beneficiary for our analysis as financial market and real economic variables are in fact endogenous ones, therefore we could also obtain exogenous financial shocks and avoid the endogeneity problem. We can also mention another aspect, concerning the impulse responses which are used as weights, as a result being able to analyze dynamic responses of real economy to financial shocks.

The following SVAR model is estimated individually for each of the countries in our sample:

$$AX_t = B(L)X_{t-1} + \varepsilon_t \quad (1)$$

X is a vector of variables presented in the Appendix A. The matrix *A* contains the contemporaneous structural parameters. *B(L)*is a matrix polynomial in the lag operator, L. ε_t is the vector of structural disturbances, such that:

$$\varepsilon_t = Ae_t \quad (2)$$

e_t is a vector of residuals from the corresponding reduced-form VAR.

We consider important the assumption that emerging economies have a very little impact on major advanced economies. Therefore it is proper to treat the foreign variable as exogenous to domestic economic variables. A block exogeneity restriction

is imposed to our model, which will help to identify foreign shocks from the point of view of the small open economy. We are interested only in their impact on such an economy, and not in any interaction among domestic variables themselves. (Zha & Cushman, 1995).

To describe the reduced VAR system for a small open economy, we are going to divide the set of variables X_t into two blocks:

$$X_t = (X_{1,t}, X_{2,t}) \tag{3}$$

$$X_{1,t} = (FSI_t) \tag{4}$$

$$X_{2,t} = (GDP_t,\ CPI_t,\ INT_t,\ EXR_t) \tag{5}$$

where $X_{1,t}$ represents the foreign block, and $X_{2,t}$ represents the domestic block.

We can also represent the VAR as follows:

$$X_t = \begin{bmatrix} X_{1,t} \\ X_{2,t} \end{bmatrix} \qquad B(L) = \begin{bmatrix} B_{11}(L) & B_{12}(L) \\ B_{21}(L) & B_{22}(L) \end{bmatrix} \qquad v_t = \begin{bmatrix} v_{1,t} \\ v_{2,t} \end{bmatrix} \tag{6}$$

where $B_{11}(L)$ and $B_{12}(L)$contain the coefficients that correspond to the foreign economy while $B_{21}(L)$ and $B_{22}(L)$ contain he coefficients corresponding to the domestic economy. The A_0 matrix in equation (1) can also be decomposed as follows:

$$A_0 = \begin{bmatrix} A_{0,11} & A_{0,12} \\ A_{0,21} & A_{0,22} \end{bmatrix} \tag{7}$$

We assume that the domestic variables do not Granger cause the foreign variables, and the later ones are predetermined. Thus a block exogeneity is imposed, excluding all domestic variables from the foreign block of equations both contemporaneously and in the lag structure of the reduced form VAR. The following restrictions are necessary:

$$A_{0,12} = 0 \ \text{ and } B_{12}(L) = 0 \tag{8}$$

As follows we show the vector of structural disturbances in equation (1), considering the assumptions made:

$$\begin{bmatrix} \varepsilon_{FSI} \\ \varepsilon_{GDP} \\ \varepsilon_{CPI} \\ \varepsilon_{INT} \\ \varepsilon_{EXR} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} e_{FSI} \\ e_{GDP} \\ e_{CPI} \\ e_{INT} \\ e_{EXR} \end{bmatrix} \tag{9}$$

As a result the Financial Stress Index is not affected contemporaneously by the country specific variables. The later ones are ordered following (Mojon & Peersman, 2001). Price levels are considered to react contemporaneously to the changes in output, being explained by the output-inflation tradeoff. (Romer, 1996) According to Taylor Rule principle, the short term interest rates are assumed to respond to changes in prices and economic activity or in our case Gross Domestic Product. (Taylor, 1993).

Therefore the matrix of lagged coefficients, *B(L),* is structured as follows.

$$B(L) = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & b_{23} & b_{24} & b_{25} \\ b_{31} & b_{32} & 1 & b_{34} & b_{35} \\ b_{41} & b_{42} & b_{43} & 1 & b_{45} \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 \end{bmatrix} \tag{10}$$

4.2 Data description

We are using monthly data from 1999:1 onwards 2009:12 therefore the SVAR model we are estimating comprises 132 observations. The sample period is chosen conditioned on the availability of data, as for example the Financial Stress Index (FSI) constructed by Roberto Cardarelli is available until December 2009. However for specific countries the sample period is shorter caused by the unavailability of data.

We should mention that the ten countries that represent the subject of our analysis are randomly selected out of the list of Emerging Countries according to

IMF classification. All the macroeconomic data are collected from publicly available reports and database of domestic institutions such as Statistical Office or Central Bank and international institutions such as European Central Bank. Detailed description and sources of variables are given in the Appendix A.

The dataset is comprised of the aggregate FSI of the Advanced Economies and macroeconomic variables such as Gross Domestic Product (GDP), Consumer Price Index (CPI), nominal interest rate and exchange rates. Since the GDP data are available at quarterly frequency, we have applied quadratic match interpolation method, after which we had seasonally adjusted the data and log-linearized it. As a measure of prices we are using the log-linearized CPI. Moreover we are using as log levels in the case of exchange rates. The purpose of these transformations is to achieve stability of the VAR system. We have left unchanged the interest rates, however their nature differs from country to country, which was conditioned by the availability of data.

As follows we will present the empirical results of our research based on the Structural Vector Autoregressive (SVAR) model described in the methodology section.

4.3 Empirical Results

As the starting point of our analysis we tried to find the optimal lag length. We can observe that Jmulti offered us different results for the countries based on information criteria, the optimal number of lags being searched up to 10. The output of information criteria results obtained and the lag length selected in each case are presented in table 4.1.

Additionally we run the model with different lags than those offered by the software. Therefore we have chosen the lag length fitting best the stability tests (CUSUM tests, CHOW test), and showing better capture of the available information (residual analysis) in the analysis of the underlying dynamics of the system. As well

Table 4.1 Lag length selection criteria output

	country	AIC	FPE	HQC	SC	Lag length chosen for SVAR
1	Czech Republic	12	11	4	1	4
2	Hungary	7	7	2	1	3
3	Poland	7	7	2	1	4
4	Romania	10	10	1	1	4
5	Russian Federation	8	7	2	1	3
6	Brazil	2	2	2	2	2
7	Turkey	4	4	2	1	2
8	South Korea	9	9	2	1	3
9	India	10	10	8	1	3
10	China	10	4	4	1	5

we tried to keep the lag length as low as possible as to preserve the degrees of freedom.

The estimation coefficients as well as the results of the performed tests can be found in the Appendix. These are available only for the lag length chosen for the SVAR estimation.

Impulse responses are performed with a 95% confidence interval that is represented by the dashed lines in the respective figures, reflecting uncertainty of the estimated coefficients.

4.3.1 Czech Republic

Figure 4.1 displays the dynamic responses of the output (GDP), prices (CPI), interest rates and exchanges rates to the external financial shock which is represented by the aggregate FSI of advanced economies.

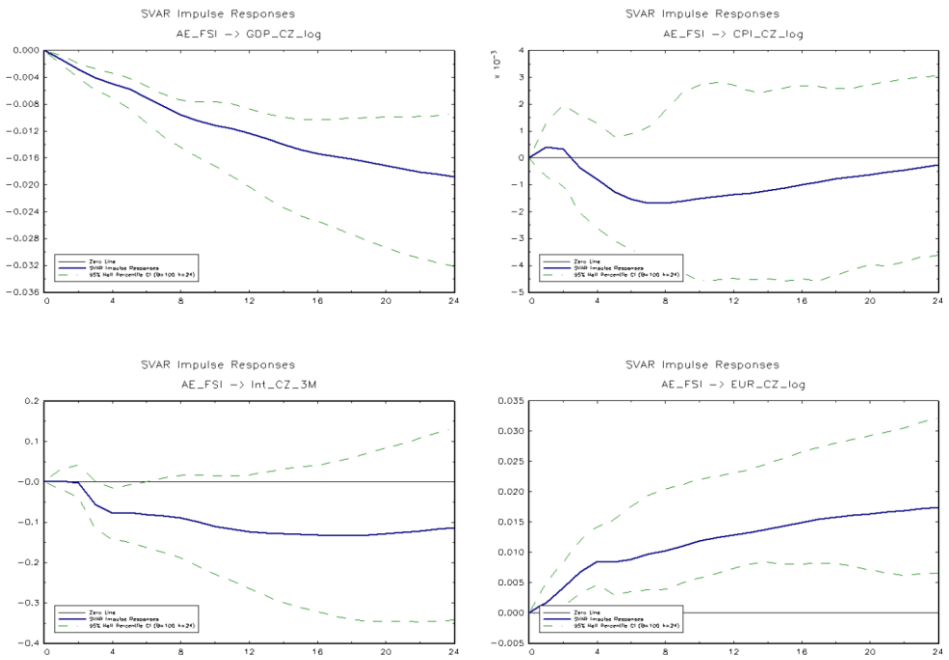

Figure 4.1 Impulse Response of Czech Republic variables to Financial Shock

Analysing the figure we can observe that an increase in financial stress leads to a persistent drop in GDP. The effects are statistically significant during 24 months. One standard deviation increase of FSI, representing 147 basis points, leads to a decrease of GDP by 0.0124 percentage points (p.p.) after 12 months, which has an economicaly neglectible segnificance. Meanwhile same increase in FSI has no statistical significant effects over the price levels. The impact of the FSI on interest rates is statistically segnificant only for a short period of time starting with month four to six. The interest rates drop by 0.0808 p.p. valid for the statistical significant period. However the interest rates tend to decline by as much as 0.1327 p.p, and starting the month nineteen tend to come back to its initial state. Nevertheless we can not be sure of the statistical sinificance of these results.Speaking about the exchange rates we can observe statistically significant results starting second month. The local currency registers a persistent devaluation comparing to EUR currency throughout the period, that is one standard deviation increase in FSI leads to as much as 0.0174 p.p. change in exchange rate.

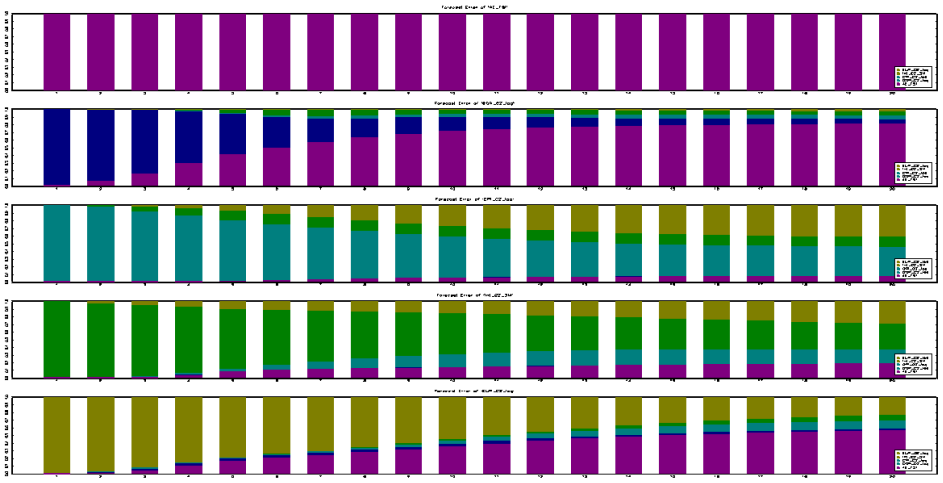

Figure 4.2 FEVD of Czech Republic variables

The Forecasted Error Variance Decomposition (FEVD) results represented in figure 4.2 show that the FSI has a significant predicting power of GDP. Starting sixth lag the FSI manages to predict more than 50 percent of output values. The price levels can be mostly predicted by its own lag values for at least five months, after which we can notice an increase in predicting power from the side of interest rates and exchange rates. Each of them manages to describe up to 13 percent and 41 percent respectively out of price development. The FSI manages to reach over 5 percent predicting power only after ninth month. The highest impact on the development of interest rates is proved to be its own historical development, nevertheless exchange rates can predict up to 29 percent of its development, followed by FSI and price levels, having mostly the same impact. Only after thirteen months the financial stress manages to have a higher predicting power of exchange rate development than its own lags. We should mention that the development of prices and interest rates can predict up to 11 percent and 7 percent respectively out of actual value of exchange rates.

4.3.2 Hungary

As follows we are going to present the impulse responses of macro variables related to Hungary, as a result of a shock in financial system in advanced countries.

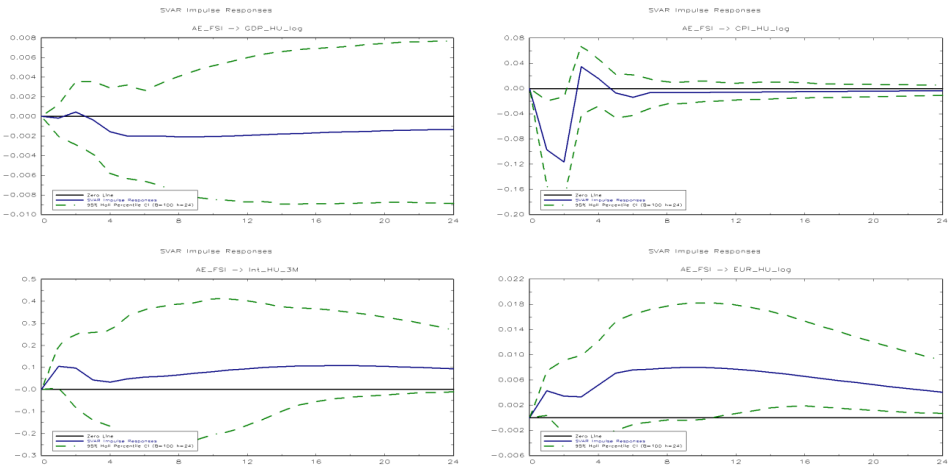

Figure 4.3 Impulse Response of Hungary variables to Financial Shock

Analyzing the figure 4.3 we can see that the only statistical insignificant results are obtained in the case of GDP. However we can observe a drop by 0.0021 p.p. as a result of one standard deviation increase in FSI, the effects diminishing in time. Concerning the price level, we can say that it drops by 0.1167 p.p. in the second month. As a result of 147 index points increase in FSI we can observe that interest rates will increase by 0.1058 p.p. in the first month but tending to return to its initial state in the folowing three moths. We can also observe a small devaluation of the local currency and mainly the exchange rate is increasing by 0.0043 p.p. which is not economically significant.

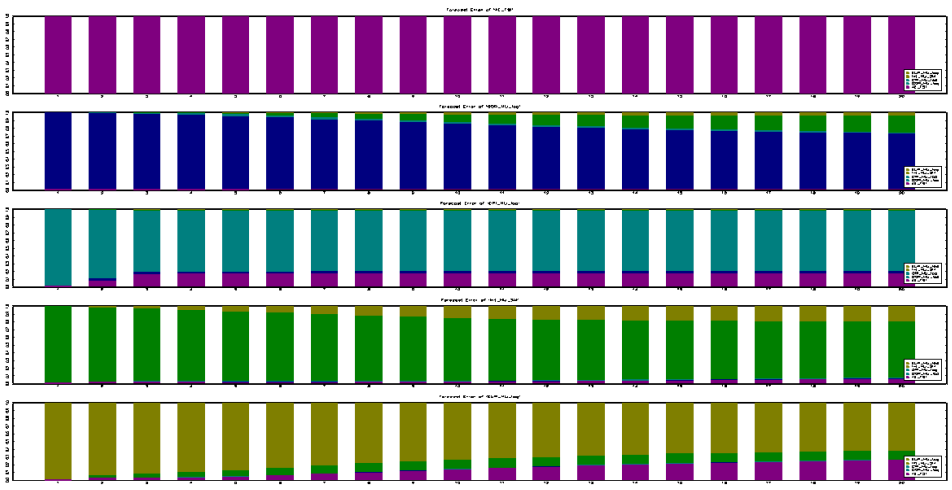

Figure 4.4 FEVD of Hungary variables

Furthermore the analysis of the FEVD could explain us how important are the external financial shocks in explaining domestic variables. Thus analyzing the figure 4.4 we can observe that GDP is predicted mainly by its own lag, but starting fourth month we can observe an increase in predicting power of the interest rate reaching up to 21 percent. The price levels are mainly influenced by its historical development, the FSI having a predicting power of up to 17 percent. We can also observe minor influence from interest rates and GDP, and no influence from the side of exchange rates. The main drivers in determining the development of interest rate represent its own historical development and the exchange rates, the last one managing to predict up to 20 percent. Meanwhile the FSI can predict only 6 percent of the interest rate development. We can observe the same pattern in the case of exchange rate. Its future value is mainly influenced by its own lag, FSI predicting up to 23 percent and being followed by the interest rate levels.

4.3.3 Poland

Figure 4.5 reflects the impulse responses of Poland macroeconomic variables to the shock in financial sector of advanced economies.

We have obtained insignificant results for GDP and interest rate. However one standard deviation increase in FSI leads to 0.0030 p.p. increase in price levels, which are statistical significant for a short time period sixth to fourteenth month.

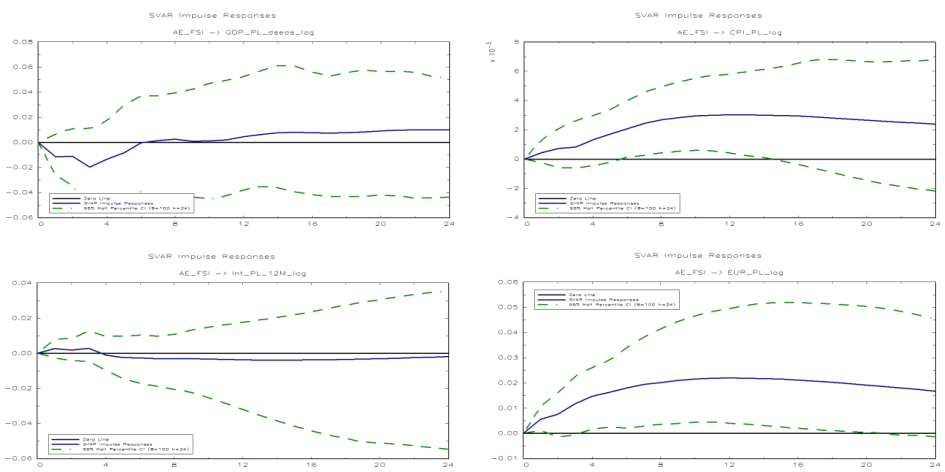

Figure 4.5 Impulse Response of Poland variables to Financial Shock

In the case of exchange rates, a financial shock in advanced economies leads to an increase statistically significant in the first month. The statistical significance period continues from fourth to twenty-first month. The local currency devaluation continues up to 0.0219 p.p. reached in thirteenth month, after which it slightly decreases.

Analyzing of the FEVD we can say that the Poland's GDP is explained mainly by its own lags. A minor variation in GDP is also explained by interest rate and exchange rate, the later one explains up to 18 percent. The innovation shock of advanced economies financial stress explains up to 33 percent of price level growth. The rest of the variation is explained by exchange rate – up to 26 percent, GDP – up to 25 percent and interest rate – up to 16 percent. However initially the price levels manage to be explained by its own lag until sixth month. Corresponding to impulse response analysis the FEVD proves that innovation shock of financial stress does not explain the variation in interest rate. Nevertheless GDP development predicts up to 40 percent, the rest of the variation being mainly explained by interest rate lag. Financial stress in advanced economies explains up to 38 percent of exchange rate variation, though a higher importance in explaining it has its own lag.

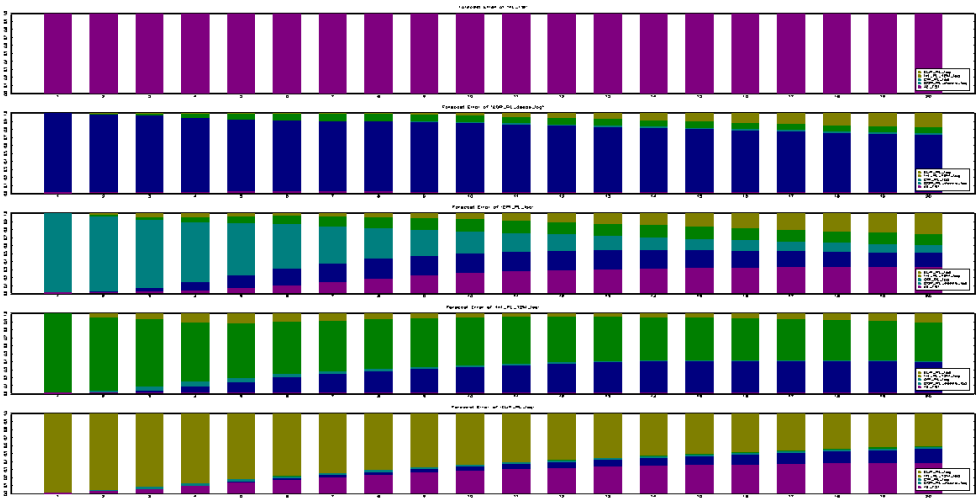

Figure 4.6 FEVD of Poland variables

4.3.4 Romania

Because there is no available data for GDP (2000:1) and interest rates (2003:1), we are going to simulate two different models. The first one includes the

full sample period, and the second one includes the period 2003:1 to 2009:12. Guiding the stability tests we are going to analyze further only the reduced sample period model.

Figure 4.7 reflects the impulse responses of Romanian macroeconomic variables to innovation in financial stress of advanced economies. Thus 147 index points increase in FSI leads to a decrease in GDP by 0.1098 p.p. The results are statistically significant throughout the period. We can also say that one standard deviation increase in FSI leads to an increase in consumer price index. That is the price level is increasing by as much as 0.0095 p.p. The results are significant only after nineteenth month. In the case of interest rate we can claim that FSI has no significant influence. Our results also indicate that an increase in financial stress leads to a depreciation in local currency by 0.0632 p.p. These results are statistically significant starting fourth month.

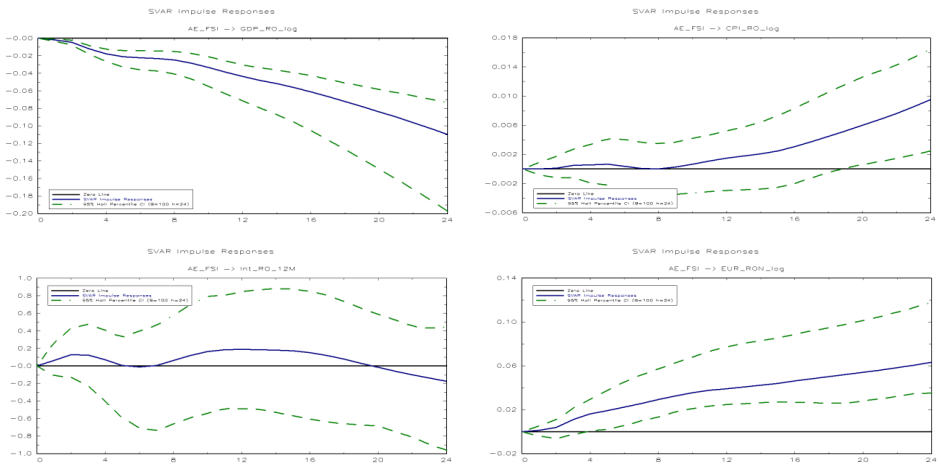

Figure 4.7 Impulse Response of Romania variables to Financial Shock

Considering the impulse response results we can continue with the FEVD analysis. Thus we can observe that nearly 89 percent of the variation in GDP is predicted by the financial stress in advanced economies. We can also claim that innovation shock of advanced economies financial stress explains up to 38 percent of price level growth. The rest of the variation in price level, is explained by its own lag, however we should consider the predicting power of exchange rate and GDP. As it was expected the FSI has no predicting power over the interest rate, its evolution being mainly explained by exchange rate. The later variable however is mainly influenced

by the financial stress. Thus up to 79 percent variation in exchange rate is explained by the FSI.

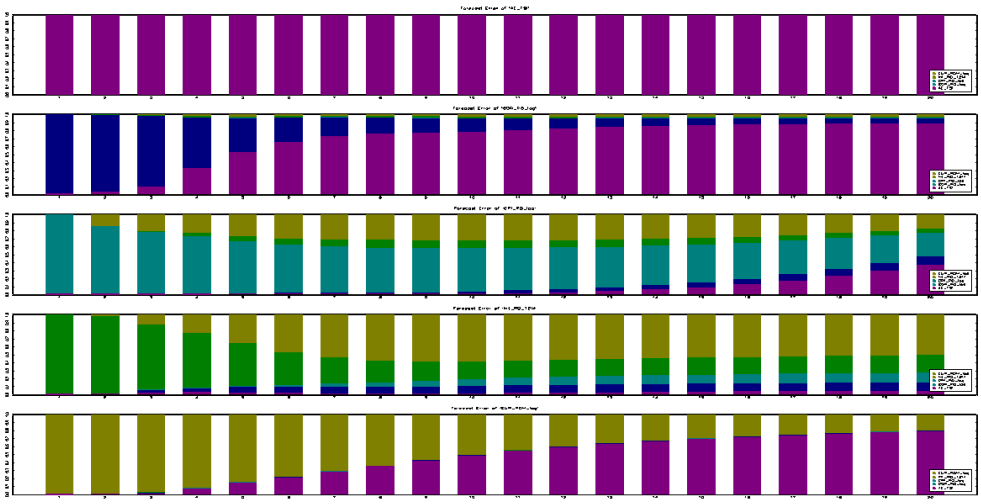

Figure 4.8 FEVD of Romania variables

4.3.5 Russian Federation

In figure 4.9 we can observe that one standard deviation increase in FSI will lead to a constant decrease in GDP by up to 0.0227 p.p. being statistically significant only starting sixth month. We can also say that the results are not economically significant.

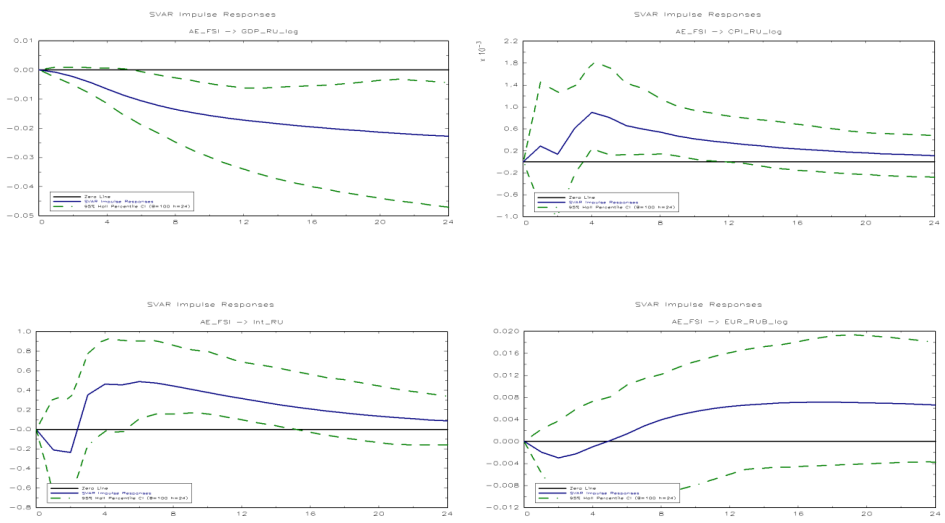

Figure 4.9 Impulse Response of Russia variables to Financial Shock

The impulse response of CPI indicates an initial increase, after which the price level slightly declines. Thus one standard deviation increase in FSI leads to an increase by 0.0009 p.p. in price level, after which it decreases to the level of 0.0004 p.p. The values correspond to the statistical significant period; nevertheless it has no economic impact. In response to the shock in FSI, interest rate registers an initial decline after which it increases steeply. Considering only the statistic significant period we can observe a continuous decrease in interest rate between sixth and fifteenth month. Thus from 0.4864 p.p. it decreases to 0.2319 p.p. which makes us judge of a negative correlation between the FSI and interest rate. In the case of exchange rates the impulse response results are not significant.

Despite the fact that FSI does not have a high predicting power of the domestic variables, the FEVD analysis confirms again the results obtained during impulse response analysis. Thus the GDP variation is mainly explained by its own lags, the financial stress managing to explain only up to 32 percent. In the case of consumer price index, the financial stress in advanced economies has even a lower predicting power reaching 11 percent in twentieth month. We can also say that only 18 percent of variation in interest rates is explained by FSI. A minor influence on its development has the exchange rate and price levels, but majorly it can be predicted by its own lag. As the impulse response analysis has shown insignificant results in the case of exchange rates, the FEVD analysis confirms the results, thus only up to 7 percent of the variation in exchange rate is predicted by the FSI.

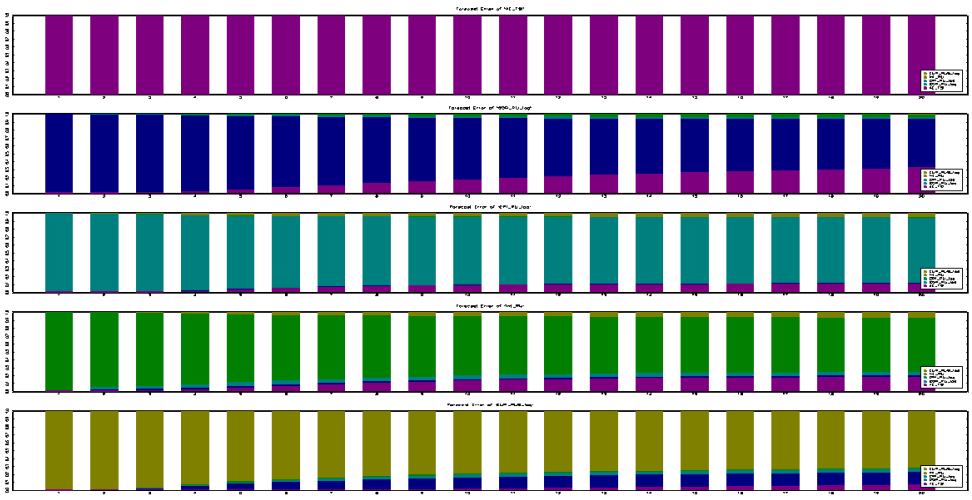

Figure 4.10 FEVD of Russia variables

4.3.6 Brazil

We have proceeded with our examining our initial model, however based on CUSUM test results, and mainly interest rate being non-stationary, we took logs of the respective variable.

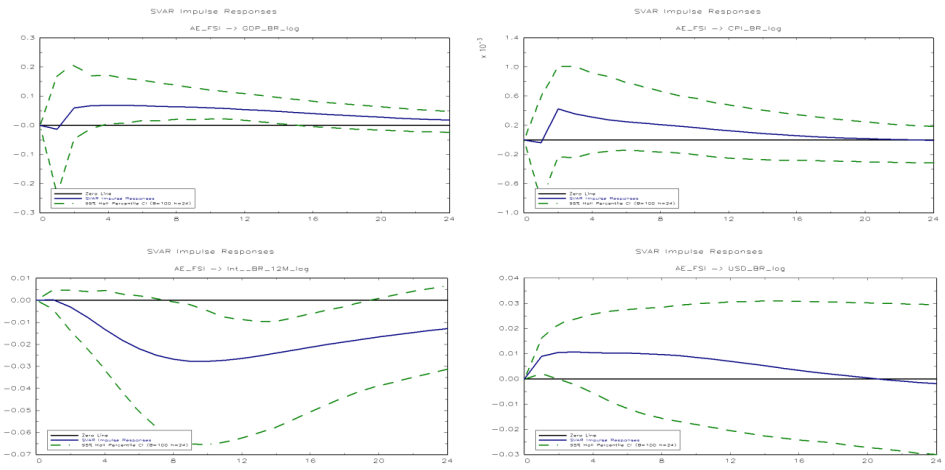

Figure 4.11 Impulse Response of Brazil variables to Financial Shock

Figure 4.11 reflects the impulse response of the Brazil macro variables to one standard deviation in FSI. Thus we can say that financial stress in advanced economies has statistical significant impact on GDP starting fourth month. Throughout the analysis period we can observe an initial decline in GDP after which it considerable increases, but the shock's impact is declining in time. Considering only the statistic significant period we can confirm a slight but persistent decline in GDP growth which has no economic significant impact. Further we can say that impulse responses of CPI to one standard deviation increase in FSI are statistically not significant. However 147 index points increase in FSI can lead to a decrease in interest rate by as much as 0.0277 p.p., impulse responses being statistically significant between eight and nineteenth month. Exchange rates register an initial increase as a result to one standard deviation increase in FSI, but the only statistically significant result is observed in the first month increasing by 0.0089p.p.

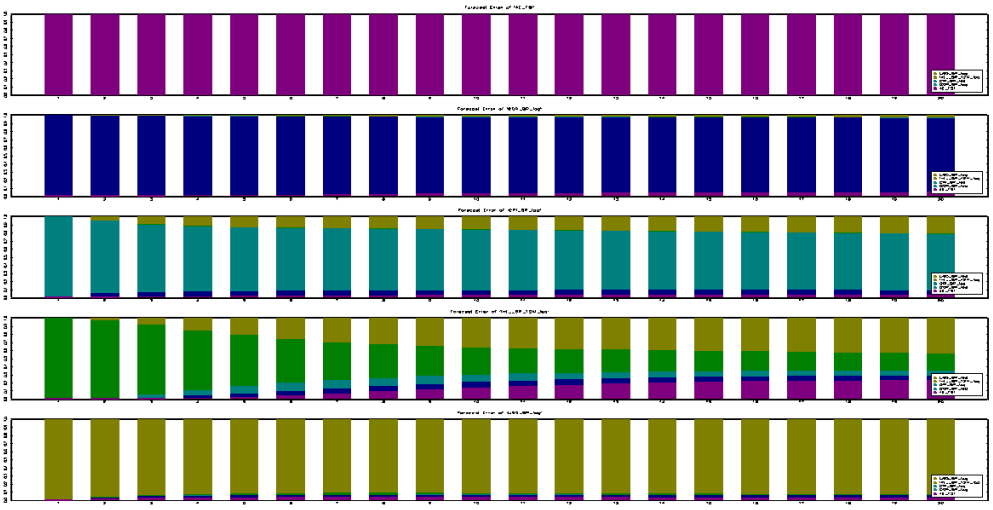

Figure 4.12 FEVD of Brazil variables

The FEVD analysis helps us obtain an introspective view upon the predicting power of the financial stress in advanced economies over the domestic macro variables. Thus we can say that GDP is mainly explained by its own lags, the FSI explaining only up to 5 percent from the variation in economic output. In the case of CPI we have obtained insignificant results during impulse response analysis, and this is explained by the fact that FSI manages to explain only up to 3 percent of the variation in price levels, a major impact having CPI historical development and exhange rates. Up to 23 percent of the variation in interest rate is explained by the financial stress, which equal to the predicting power of its own lags. The analysis shows that it is the exchange rate that have a biger influence upon interest rate development. In the case of the later one, the financial stress manages to have a higher predicting power in the midle of our analysis period, but it does not exceed 4 percent, as a results, the variation in exchange rate is mainly explained by its own lags.

4.3.7 Turkey

Figure 4.13 shows the results of impulse response of Turkey macro variables as a result of one standard deviation increase in FSI.

The analysis has proven that there is no statistical significant impact of financial stress in advance economies on Turkey's real economy.

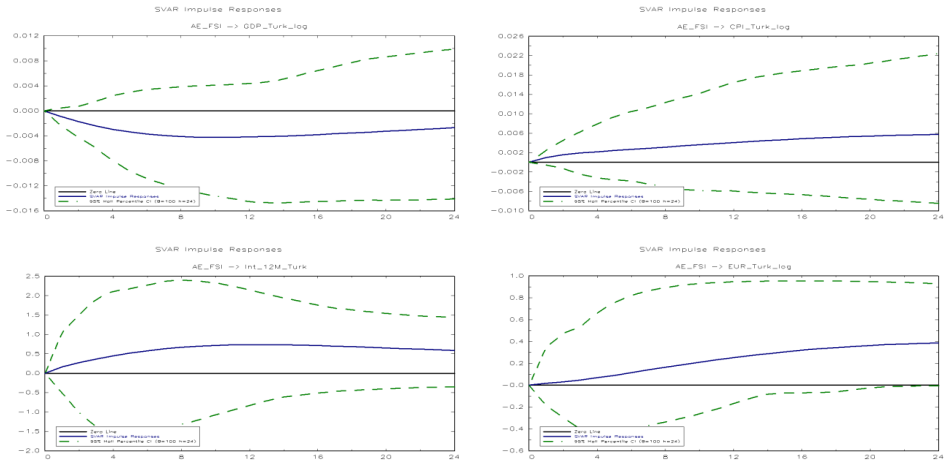

Figure 4.13 Impulse Response of Turkey variables to Financial Shock

The FEVD analysis has confirmed our previous obtained results, thus FSI manages to explain up to 5 percent of the variation in GDP. Thus the economic output is mainly predicted by own historical development and interest rates, which manage to explain up to 21 percent of the variation in GDP. Price levels are mainly explained by own lags, and interest rates which explain up to 70 percent and 43 percent respectively of the variation in CPI. The FSI manages to explain only up to 3 percent. The results also indicate that interest rates are mainly predicted by its historical development, the FSI explaining only up to 6 percent of variation in interest rates. We can also say similar results are obtained in the case of exchange rate, financial stress explaining only up to 7 percent of the variation, a more important determinant representing own lags, GDP and CPI.

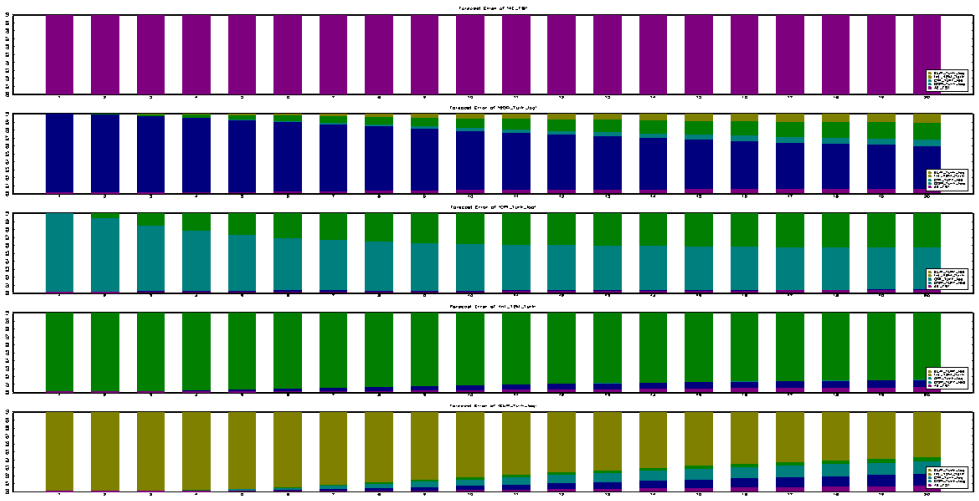

Figure 4.14 FEVD of Turkey variables

4.3.8 South Korea

During our initial analysis taking log of the variables lead us to questionable results that were contradictory to the economic theory. These results were possible caused by the instability of the model. First differentiating the variables will lead in loss of information, but we reached system stability that is important for VAR.

Figure 4.15 shows the impulse responses of South Korea macroeconomic variables as a consequence of one standard deviation increase in FSI.

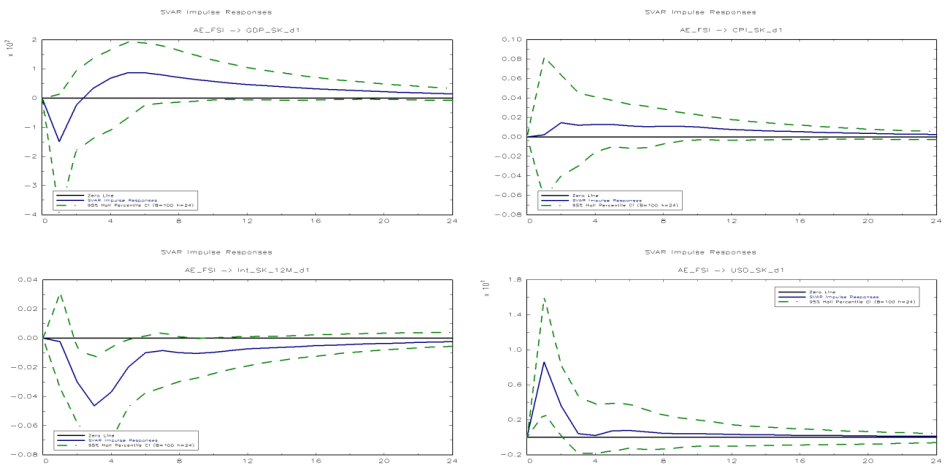

Figure 4.15 Impulse Response of South Korea variables to Financial Shock

The results have shown that financial stress has no statistical impact upon GDP and CPI of South Korea. However the analysis has proven statistical significant results for the interest rate between second to fifth month, and ninth month. Therefore one standard deviation increase in FSI leads to a decrease in interest rate by up to 0.0465 p.p. The analysis have also shown considerable devaluation of the local currency, an increase in financial stress leading to an increase in exchange rate by 8.6216 p.p statistical significant in the first two months.

The FEVD analysis is confirming the previous obtained results. The FSI manages to explain up to 5 percent and 1 percent of the variation in GDP and CPI respectively. In the case of interest rate the highest predicting power has the historical development of the variable. Financial stress in advanced countries explains up to 10 percent of the variation in interest rate. We can observe similar results in the case of exchange rate, only 9 percent of variation being explained by the FSI.

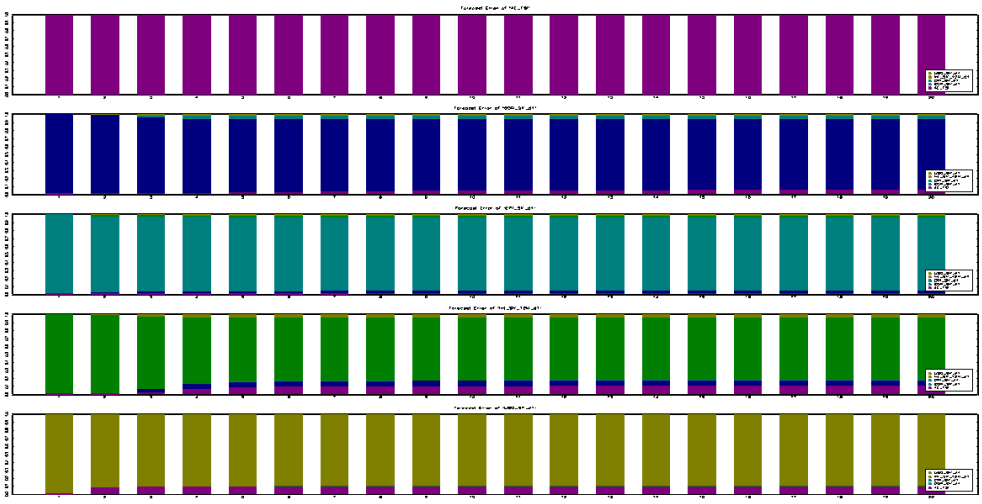

Figure 4.16 FEVD of South Korea variables

4.3.9 India

Figure 4.17 represents the impulse response results of India macro variables as a consequence of one standard deviation increase in FSI.

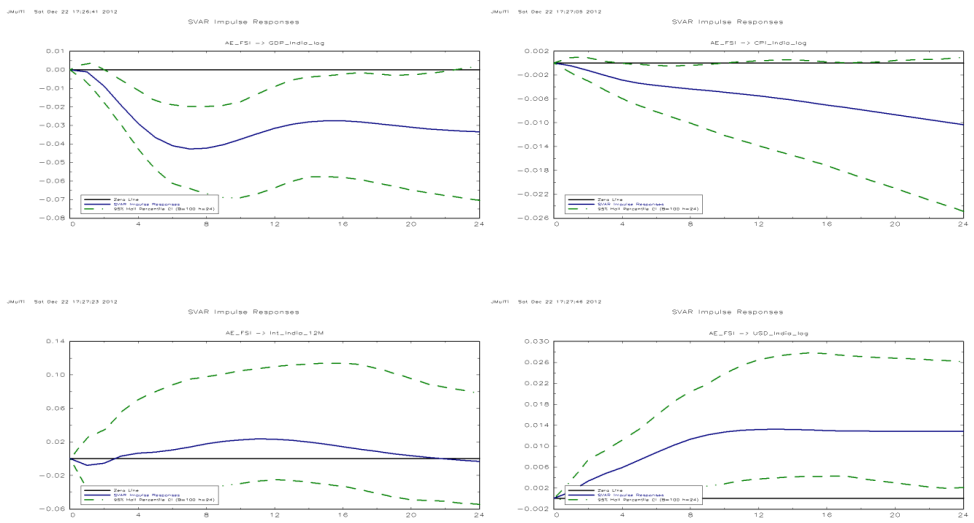

Figure 4.17 Impulse Response of India variables to Financial Shock

Economic output is decreasing by 0.0428 p.p., showing statistical significant results starting third to twenty second months. We can also see that CPI is also decreasing by up to 0.0049 p.p. in the statistical significant interval which is between fourth and tenth month. This may be considered an unexpected result, but there is no economically significant impact. We can also say that financial stress in advanced

economies has no impact on India's interest rate, as the results obtained indicate no statistically significance. In the case of exchange rate we can observe that one standard deviation increase in FSI leads to a persistent devaluation in local currency by up to 0.0132 p.p.

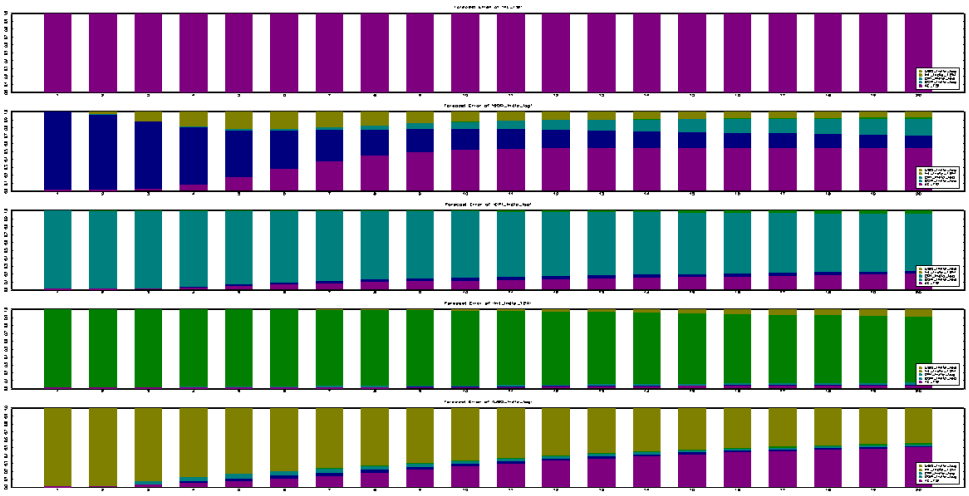

Figure 4.18 FEVD of India variables

The FEVD analysis shows that up to 54 percent of variation in GDP is explained by financial stress. The economic output is also influenced by its own lags, price levels and exchange rates. The FSI also manages to predict up to 20 percent of variation in price levels, however the main determinant represents its own historical development. The impulse response analysis has shown statistical insignificant results in the case of interest rates, and now we can claim that FSI explains only up to 3 percent of the variation in interest rate. Financial stress in advanced economies explains up to 50 percent of exchange rate variation, having almost the same importance in explaining it as its own lag.

4.3.10 People's Republic of China

Figure 4.19 reflects the impulse responses of China macroeconomic variables to innovation in financial stress of advanced economies.

Thus 147 index points increase in FSI leads to a decrease in GDP by as much as 0.0116 p.p. We can observe a decrease in GDP however the effect is not stable registering a variation in time. The results are statistically significant starting third to

thirteenth month than seventeenth to the end of the study period. We can also say that one standard deviation increase in FSI leads to a positive but diminishing effect on consumer price index. That is the price level is increasing by as much as 0.0015 p.p. The results are significant only in seventh and eighth month. In the case of interest rate we can claim that FSI has no significant influence. Our results also indicate that an increase in financial stress leads to an appreciation in local currency by 0.0073 p.p. These results are statistically significant starting eleventh to twentieth month.

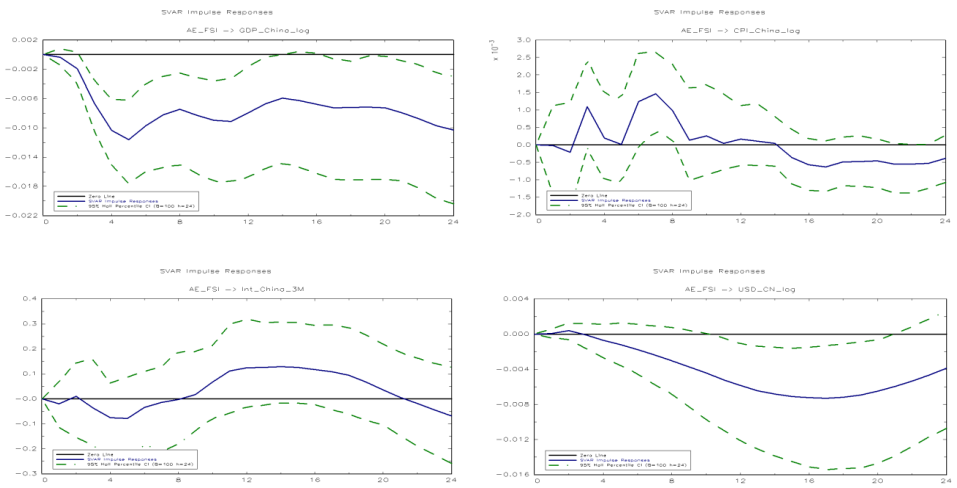

Figure 4.19 Impulse Response of China variables to Financial Shock

Analyzing of the FEVD we can say that the China's GDP's development is mainly influenced by financial stress in advanced economies and own historical development. The innovation shock of advanced economies financial stress explains up to 15 percent of price level growth. The main determinant of price level evolution still remains its own lags. Despite obtaining insignificant result during impulse response analysis, financial stress explains up to 17 percent of variation in interest rate. Interest rate is also influenced by economic output, exchange rate and own historical development. In the case of exchange rates we can say that up to 60 percent of the variation is explained by FSI.

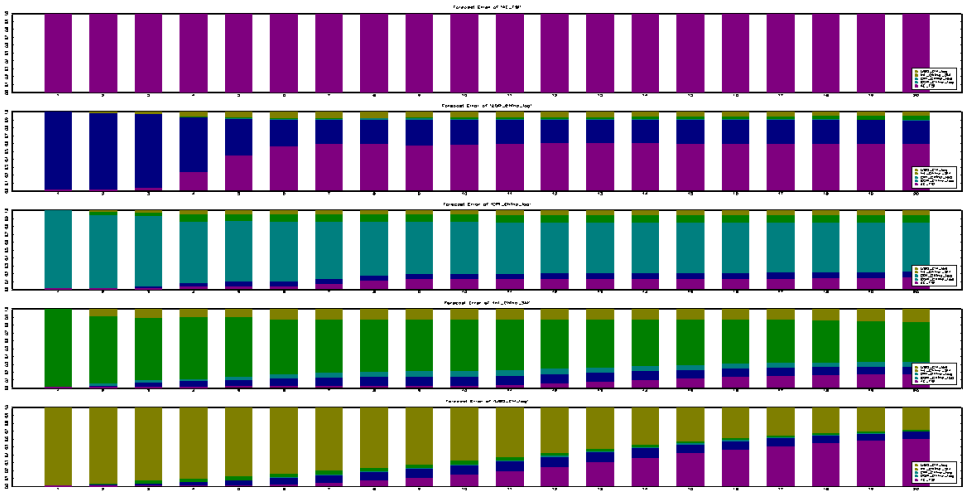

Figure 4.20 FEVD of China variables

4.4 Results Interpretation

Interpreting our results we should take in consideration the fact that the FSI used as a proxy for the level of financial shock represents an aggregate value of all FSI in Advanced Economies. As countries are not interconnected at the same level, depending on different geo-economic criteria, we are expecting a lower intensity in the impact global financial shock, originated in developed countries, having upon real economy of countries included in our sample.

Guiding the obtained empirical results we can conclude that a global financial shock in developed countries has a persistent contractionary effect upon output. In six out of ten countries, output persistently declines starting the first months. Despite the fact that we can observe slight variation in GDP growth rates, or differences in significance periods, we can observe a long term impact of financial stress on output. Comparing the predicting power of Financial Stress Index and domestic variables, we can conclude that output in Czech Republic, Romania, India and China have been affected more by external financial conditions, while domestic ones account for the majority of the variation in Brazil and Russia's output. The persistency of the external financial shock is confirmed in similar researches and findings regarding the recent financial crisis, that is: (Babecký & Havránek, 2012) or (Hwa, April 2012).

We can also claim that financial shock has a deflationary effect for: China, India, Russian Federation and Hungary. The only cases when we registered an

inflationary effect are Poland and Romania and no effect for: Czech Republic, Brazil, Turkey and South Korea. We should mention that the only statistical significant effects in the case of Poland and Romania were observed in long-run, where confidence intervals widen. Nevertheless, analyzing the overall influence of financial shocks on macroeconomic performance, we concluded that more than 60 percent of the variation in prices level can be attributed to country specific factors.

In five out of ten countries we have identified a statistical significant impact of global financial shock upon interest rate. We can conclude that a global financial shock in advanced countries leads to an ease of monetary policy in the following specific countries: Czech Republic, Hungary, Russian Federation, Brazil and South Korea. Our results also indicate that more than 70 percent of the variation in interest rates is explained by domestic macroeconomic conditions.

A global financial shock in advanced countries also causes devaluation of local currencies, except the Chinese Yuan. The only insignificant results were obtained in the case of Russia and Turkey. Our empirical results also indicate that exchange rate have been affected more by country specific factors in the majority of countries except Romania, China and India, were in long-run financial conditions in advanced countries have a higher impact. Knowing this we can explain the Chinese Yuan appreciation, being due to the special trade relations between the U.S and China.

As a result we can see that country specific factors have dominant influence in the evolution of emerging countries during the recent financial crisis. These results majorly reflect the economies' differing degree of reliance on external financing and their role in the world financial system. Transmission channels described in the section 3.2 of this paper offer us a general theoretical understanding of the country specific factors that can impact the performance of the emerging countries. Further analysis could answer whether it is the financial and economic linkages that matter, or domestic variables which are driven by policies and structural characteristics. And mainly including in our model one of the variables described in section 3.2, which we leave for future research.

5 Conclusion

In our study we have seen that the world financial system has suffered serious changes due to financial innovation and policy imperfections. Both macroeconomic and microeconomic conditions lead to the current financial crisis as we know it today. Low interest rates fueled the demand for credits and investments leading to significant increase in house prices. On the other side, they also offered the premises for financial innovation which was supposed to provide the necessary yield for bankers and institutional investors. However the proper drawbacks such as sacrifice of transparency and increasing risk, turned to be main causes for losing control over the financial system. As concerning the policy imperfection we also discussed the moral hazard that is created by the existence of such a concept as Too Big-to-Fail or the "shadow" banking.

Analyzing the available statistics we could observe that the global output registered negative dynamics, contracting by an alarming 6.96 percent in the fourth quarter of 2008 and 5.84 percent in the first quarter of 2009. World economy has known decreases in industrial production by 12.07 percent, investments reduced by as much as 21.51 percent and world trade by 10.7 percent. The analysis of nonperforming loans growth rates gave us a perspective of the dynamics in economy and housing market, but impact upon the banking system is sized giving the volumes of write-downs that amounted 2.3 trillion U.S. dollars. The performance of countries has been heterogeneous, but we could claim that emerging countries registered a faster recovery than advanced ones.

These results lead us to the idea that the depth of the crisis in each country depends on the development and structure of the financial system. And mainly it may be and important aspect to be taken in consideration when analyzing the degree of interconnectedness between financial sector and economy. On the other side we should also consider the channels of financial stress transmission from developed to emerging countries, as the recent crisis originated and affected mostly the advanced ones. A theoretical overview outlined several channels directly connected to the recent financial crisis, such as: the exposure to U.S. asset backed by sub-prime

mortgages and dependence of emerging country's financial institutions on dollar financing. Financial stress can also be channeled through trade linkages. Declines in exports to developed economies impact majorly in turn the investments and industrial production.

However we find more relevant to classify the channels as common factors and country-specific factors. The first one is reflecting the impact of global shocks leading to herd behavior, cross-country contagion, and common-lender effect. In this group we can include the Financial Stress Index reflecting the market sentiment and the financial conditions in developed countries. The country-specific factors mostly refer to economic and financial linkages. As well, here we should take in consideration the structure of the economy, the development level of the financial sector, monetary policy and domestic vulnerabilities, etc.

Thus applying a SVAR model with block exogeneity restriction we aimed to determine if there is any empirical proof of financial stress transmission from Developed to Emerging countries. Also determining which of these two groups of channels matter the most in the transmission process, will allow us to understand if international financial integration represents the decisive factor in Financial Stress transmission.

Our empirical results indicate that financial stress in developed countries has a persistent contractionary effect upon output in six out of ten countries in our sample. We can also claim that financial stress is significant starting first quarter having a long term impact. More, we can also state that for Czech Republic, Romania, India and China, the transmission process lies through the common factors, thus financial stress in developed countries having a major predicting power, while the country specific factors would be more important in the case of Russia and Brazil.

We have also found that financial stress has a deflationary effect in China, India, Russian Federation and Hungary. However our analysis proved that the price level variation in sample countries is mainly influenced by country-specific factors.

Domestic macroeconomic conditions are also dominant in explaining the evolution of interest rates. But we also concluded that financial stress in advanced

countries leads to an ease of monetary policy, interest rates dropping aiming to offer stimuli for economic recovery.

As a result of our empirical analysis we can also claim that financial stress in developed countries causes devaluation of local currency, the Euro and U.S. dollar having a better performance during the study period. We also concluded that common factors as well as country-specific factors are to be considered in financial stress transmission process from developed to emerging countries. The first group of factors is relevant only for Romania, China and India.

Overall as a result of our analysis we realized that the financial stress transmission from developed to emerging countries has been complex and cannot be reduced to analyzing the issue from one aspect. We can observe a major influence of country-specific factors in explaining the evolution and variation in domestic variables, respectively we can conclude that economic and financial linkages, or better said, the level of international financial integration of the specific countries represents an important condition for the financial stress transmission. Nevertheless analyzing the performance of output in respective countries, in four out of six countries where a significant impact was registered, common factors represent the main drivers. Therefore we can conclude that a cross country contagion took place. In conclusion we would like to state that it would not be correct to attribute a single cause or factor as being determinant for the financial stress transmission from developed to emerging countries.

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Appendix A: Variables Description

Country	Variable	Description	Period	Source
Czech Republic	*GDP*	Gross Domestic Product from the Income Side, Current Prices; mil. Kč / CZK mil.	1999-2009	Czech National Bank
	CPI	Real price level, Annual CPI (%)	1999-2009	Czech National Bank
	Interest	PRIBOR rates - monthly and yearly averages (%)	1999-2009	Czech National Bank
	Exchange rate	ECB reference exchange rate, Czech koruna/Euro	1999-2009	European Central Bank
Hungary	*GDP*	Gross Domestic Product at current prices	1999-2009	Hungarian Statistical Office
	CPI	Core inflation based on December 1994, Price level	1999-2009	Hungarian Statistical Office
	Interest	BUBOR (Budapest Interbank Offer Rate) (%)	1999-2009	Hungarian Statistical Office
	Exchange rate	ECB reference exchange rate, Hungarian forint/Euro	1999-2009	European Central Bank
Romania	*GDP*	Gross Domestic Product, CAEN time series; Million lei + GROSS DOMESTIC PRODUCT 2008-2012 - UNADJUSTED SERIES; millions of lei curent price	2000-2009	National Institute of Statistics
	CPI	Inflation, Price level	1999-2009	National Institute of Statistics
	Interest	Monetary policy interest rate, %p.a.	2003-2009	National Institute of Statistics
	Exchange rate	ECB reference exchange rate, Romanian lei/Euro; Starting 1st July 2005, 1RON = 10,000 ROL	1999-2009	European Central Bank
Poland	*GDP*	Current prices, in PLN millions	1999-2009	National Bank of Poland
	CPI	Current inflation (CPI y/y lagged 2 months, known to respondents when the survey was carried out)	1999-2009	National Bank of Poland
	Interest	Refinancing rate (%)	1999-2009	National Bank of Poland

	Exchange rate	ECB reference exchange rate, Polish zloty/Euro	1999-2009	European Central Bank
Russia	*GDP*	Gross Domestic Product in current prices, trillion Rubles	1999-2009	Central Bank of Russia
	CPI	The average inflation of Russia	1999-2009	http://www.inflation.eu/inflation-rates/russia/historic-inflation/cpi-inflation-russia-1993.aspx
	Interest	Interbank Rate - monthly average rate MIACR on overnight interbank ruble credits.	1999-2009	http://www.cbr.ru/eng/statistics/?Prtid=cdps
	Exchange rate	ECB reference exchange rate,Russian rubl/Euro	1999-2009	European Central Bank
Turkey	*GDP*	Gross Domestic Product by Kind of Economic Activity in Basic Prices (At Current and Fixed (1998)	1999-2009	Cenral Bank of the Republic of Turkey
	CPI	1994 Based Consumer Price Index Numbers, 1994-2006 (*) The index numbers following January 2006 are derived using the monthly rate of change in 2003=100 consumer price index.	1999-2009	Cenral Bank of the Republic of Turkey
	Interest	Interest Rates on Deposits; TP.FA.F07.1	1999-2009	Cenral Bank of the Republic of Turkey
	Exchange rate	ECB reference exchange rate,Turkish lira/Euro	1999-2009	European Central Bank
South Korea	*GDP*	GDP and GNI by Kind of Economic Activity (at current prices, quarterly & annual)	1999-2009	The Bank of Korea
	CPI	Consumer price index (2005=100) - South Korea - Index; Brasilian Central Bank	1999-2009	The Bank of Korea
	Interest	Yields on CD(91-day) / per annum	1999-2009	The Bank of Korea
	Exchange rate	South Korean Won / US dollar	1999-2009	Pacific Exchange Rate Service; http://fx.sauder.ubc.ca/data.html
Brazil	*GDP*	GDP monthly - current prices (R$ million)	1999-2009	Banco Central do Brazil
	CPI	Consumer Price Index-Brazil (IPC-Br) - Monthly % var.	1999-2009	Banco Central do Brazil
	Interest	Selic accumulated in the month in annual terms - % p.y.	1999-2009	Banco Central do Brazil

	Exchange rate	Brazilian Real / US dollar	1999-2009	Banco Central do Brazil
China	*GDP*	Gross Domestic Product (100 Million Yuan)	1999-2009	Peple's Bank of China
	CPI	Consumer Price Index	1999-2009	Peple's Bank of China
	Interest	Trading Statistics of National Interbank Market Weighted Average Interest Rate 3M	1999-2009	Peple's Bank of China
	Exchange rate	Amounting to one U.S. dollar (average)	1999-2009	Peple's Bank of China
India	*GDP*	GDP at current prices, base year 1996-1997; tens of millions;	1999-2009	Reserve Bank of India
	CPI	Consumer price index of all items for industrial workers, base year 2001	2001-2009	Labor Bureau of the Government of India
	Interest	RBU Bank Rate; percent p.a.	2002-2009	Reserve Bank of India Bank Rate
	Exchange rate	INR/USD	1999-2009	PACIFIC Exchange Rate Service

Appendix B: Content of Enclosed DVD

There is a DVD enclosed to this thesis which contains empirical data and JMulti saved projects.

- Folder 1: JMulti saved Projects
- Folder 2: Empirical data